A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL ASPECTS OF ALPINIA GALANGA (A LIFE SAVING DRUG)

Prabhu Dayal Rajan*, Ayasha Saiffi, Sokindra Kumar and Pradeep Kumar Sharma

Department of Pharmacology, R V Northland Institute, Dadri, Greater Noida, G B Nagar, U.P. 203207.

ABSTRACT

**Introduction:** From the ancient Vedic era, green plants are being used for their medicinal properties to treat several diseases. Green plants represent a big source of bioactive compounds. Alpinia galanga (Linn.) of Zingiberaceae family is one amongst those medicinally important plants. It is found all over the world and commonly known as 'Kulanjan'. Different parts of this plant are traditionally claimed to be used for the treatment of ailments including anti-fungal, anti-tumor, Anti-helmintic, anti-diuretic, anti-ulcerative, disease of heart, rheumatic pains, chest pain, dyspepsia, fever, diabetes, burning of liver and kidney disease. Several active compounds such as 1'S-1'-acetoxychavicol acetate, 1’S-1'-acetoxyeuginol acetate, 1, 8-cineol, α-fenchyl acetate, β-farnesene, β-bisabolene, α-bergamotene, β-pinene, β-Sitosteroldiglucoside (AG-7), β-sitsteryl Arabinoside (AG-8), 1’-acetoxychavicol acetate (galangal acetate), p-hydroxycinnamaldehyde has been extracted from the plant. **Conclusion:** The present review aimed to compile up to date and comprehensive information of Alpinia galanga with special emphasis on its phytochemistry and various scientifically documented pharmacological activities hence Alpinia galanga is consider as a life saving drug.

**KEYWORDS:** kulanjan, Alpinia galanga, Zingiberaceae, pharmacology, Dyspepsia 1, 8-cineol.

INTRODUCTION

Every part of the world, the medicinal plants are becoming popular and their use is increasing day by day in modern society as natural alternatives.\(^1\) India possesses almost 8% of the estimated biodiversity of the world with around 0.126% million species.\(^2\) Medicinal plants
and derived medicine are widely used in traditional cultures all over the world and they are becoming increasingly popular in modern society as natural alternatives to synthetic chemicals.\[3\] In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularized in developing and developed countries owing to its natural origin and lesser side effects.\[4\]

Alpinia galanga is one of them, it have large number of chemical constituents, it is found all over the world commonly known as Kulanjan, Different parts of this plant are traditionally claimed to be used for the treatment of ailments including anti-fungal, anti-tumor, Anti-helmintic, anti-diuretic, anti-ulcerative, disease of heart, rheumatic pains, chest pain, dyspepsia, fever, diabetes, burning of liver and kidney disease. hence it is known as LIFE SAVING DRUG.\[5\]

**Important Vernacular Names\[6\]**

<table>
<thead>
<tr>
<th>Hindi</th>
<th>Barakulanjan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kannada</td>
<td>Dumparasmi</td>
</tr>
<tr>
<td>Bengali</td>
<td>Kulingjan</td>
</tr>
<tr>
<td>Gujarati</td>
<td>Kulinjan</td>
</tr>
<tr>
<td>Malayalam</td>
<td>Arattha, Kol-inji, Peraratta</td>
</tr>
<tr>
<td>Tamil</td>
<td>Peraratthei</td>
</tr>
<tr>
<td>Telugu</td>
<td>Pedda-dumparastram</td>
</tr>
<tr>
<td>Marathi</td>
<td>Kosht-Kulinjan</td>
</tr>
<tr>
<td>Sanskrit</td>
<td>Mahabaracach,Sugandha,Vacha Rasna</td>
</tr>
<tr>
<td>English</td>
<td>Greater galangal</td>
</tr>
</tbody>
</table>

**Geographical Distribution** - It is found in Indonesia, India, China, and Arabic gulf areas, Malaysia, Egypt and Sri Lanka. It grows in open sunny places, forests, and brushwood. It is commonly cultivated in the mid and low-country in Sri Lanka. The plant is distributed in Himalaya and Southern region of the Western Ghats in India. It is often cultivated in Konkan and North Kanara.\[6\]

**Taxonomic Description\[7\]**

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Order</td>
<td>Zingiberales</td>
</tr>
<tr>
<td>Family</td>
<td>Zingiberaceae</td>
</tr>
<tr>
<td>Subfamily</td>
<td>Alpinioideae</td>
</tr>
<tr>
<td>Tribe</td>
<td>Alpinieae</td>
</tr>
<tr>
<td>Genus</td>
<td>Alpinia</td>
</tr>
<tr>
<td>Species</td>
<td>Galangal</td>
</tr>
</tbody>
</table>
Morphological Description

The plant is a perennial herb. It grows up to a height about 5 feet. Leaves are oblong-lanceolate, tuberous root, slightly aromatic. The rhizome is from 3.5-7.5 cm in length, and seldom more than 2 cm thick. The leaves are long, oblong-lanceolate, acute, glabrous, ligules are short and rounded. Flowers are greenish white in colour, bracteate, bracts are ovate lanceolate. Tubular calyx, Corolla lobes oblong, claw green, blade white, striated with red, rather more than 1 cm long, broadly elliptic, shortly 2-lobed at the apex, with a pair of subulate glands at the base of the apex, with a pair of subulate glands at the base of the claw. Fruit the size of the small cherry, orange red.\[7\]

Traditional uses of Alpinia galanga

*Alpinia galanga* is an important medicinal plant in different traditional systems of medicine to treat several diseases, including microbial infections, inflammations, rheumatic pains, chest pain, and dyspepsia, fever, burning of the liver, kidney disease, tumours, diabetes and even HIV.\[8\] The seeds are used as cardiotonic, diuretic, hypotonic, gastric lesions, antiplatelet, anti-tumor, anti-fungal.\[9\] It stimulates the digestive power, appetite and acts as a purgative. The rhizome is generally used as a spice. It is also a good source of essential oil. The flowers and young shoots are also used as a vegetable or as a spice. The plant has an active role in the treatment of eczema, bronchitis, coryza, mobile, pityriasis versicolor, otitis internal, gastritis, ulcers, and cholera.\[10\]

![Alpinia galanga](image)

Phytochemical Aspects of Alpinia Galanga

Chemical investigations of the *Alpinia galanga* by jadu, S.B. *et al* (2009) reported the isolation of galangoflavonoid from the rhizomes by column chromatography and eluted with ethyl acetate- methanol (9:1) to yield a compound, galangoflavonoid.\[11\] 1’S-1’-
acetoxychavicol acetate (ACE), isolated from *Alpinia galanga* is the major compound so far reported with various biological activities.[12] Matsuda H. et al (2003) ware isolated nine known phenylpropanoids and p-hydroxybenzaldehyde (1’S-1’-acetoxychavicol acetate and 1’S-1’-acetoxyeugenol acetate) from the rhizome of *Alpinia galanga*. Kkubota k. et al (1998) reported four isomers of acetoxy cineoles (trans and cis)-2-and 3- acetoxy-1, 1, 8-cineoles from the isolated plant of rhizome. Their structures were confirmed by comparing the retention indices by GC and the mass spectra with those of synthesized compound.[14] Yang Xion Gen and Eilerman R.G. (1999) were isolated and identified 1’-acetoxychavicol acetate (galangal acetate) from rhizome of *Alpinia galanga*. The identification was done by the Gas Chromatography Analysis.[15] Jadu S.B. et al (2009) were isolated β-Sitosterol diglucoside (AG-7) and β-sitsteryl Arabinoside (AG-8), from the rhizome of *Alpinia galanga* and characterized by their spectral value.[16] Zhu X.L. (2009) were isolated by the Silica gel and Sephadex LH-20 column chromatography and spectroscopic techniques were employed to elucidate their structures. The phenylpropanoids (4,4’[2E,]-bis (prop-2-ene)-1, 1’-diphenyl-7, 7’-diacetate.[17] Someya, y. et al (2001) were isolated and identified three hydroxy-1,8 cineole glucopyranosides, (1R, 2R, 4S)-and (1S, 2S, 4R)-trans-2-hydroxy-1,8 cineole β-D-glucopyranoside, and (1R, 3S,4S)-trans-3-hydroxy-1, 8 cineole β-D-glucopyranoside, which are possible precursors of acetoxy-1,8-cineole, from the rhizome of the *Alpinia galanga*. Their structures were analyzed by FAB-MS and NMR spectrometry, and the absolute configuration of each aglycone was determined by using a GC-MS analysis with a capillary column coated with a chiral stationary phase. The composition of the diastereomers of (1R, 2R, 4S)-and (1S, 2S, 4R)-trans-2-hydroxy-1,8 cineole β-D-glucopyranosides in the rhizome was determined as 3:7 by GC-MS analysis after preparing the trifluoroacetate derivatives of the glycosides.[18] Barik, B.R. (1987) were isolated first time in nature and the latter is a new chemical component from the chloroform extract of the rhizome of the *Alpinia galanga* i.e. p-hydroxycinnamaldehyde and [di-(p-hydroxy-cis-styryl)] methane.[19]
Chemical structures of the important bioactive molecules extracted from *Alpinia galanga*.

**Pharmacological Aspects of Alpinia Galanga**

**Antimicrobial**

*Alpinia galanga* poses antimicrobial activity against various bacteria and fungi. Essential oil from fresh rhizomes of *A. galanga* exhibits an antimicrobial activity against Trichophyton mentagrophytes.[20] Similarly, the ether extract of *A. galanga* are more potent than ethyl acetate in antibacterial activity and significantly effective on *Staphylococcus aureus* and *Klebsiella pneumoniae*. [21] 1,8-Cineole from the ethanol extract of *Alpinia galanga* was discovered to have antibacterial activity against *Staphylococcus aureus*. The antimicrobial activity is due to composition of 1,8-cineole, 4-allyphenyl acetate and a-bisabolene.[22]

*Alpinia galanga* also been studied and found to be inhibit a wide range of human pathogenic fungi, zoonotic dermatophytes and yeast-like *Candida albicans*. The ethanolic extracts poses fungicidal activity against Trichophyton longifusus, *Colletotrichum musae* and *Fusarium oxysporum*, *Trichophyton mentagrophytes*, *Trichophyton rubrum*, *Trichophyton concentricum*, *Rhizopus stolonifer* and *Aspergillus niger*. [23]

**Antitumor**

*Alpinia galanga* was found to cause antitumor activity. Active compounds from *A. galanga* such as 1′-acetoxychavicol acetate and 1′-acetoxyeugenol acetate were isolated as antitumour principles against Sarcoma 180 ascites in mice.[24] The high dose of methanolic extract of *A. galanga* treated albino mice showed no estrogenic activity rather showed decrease uterine wet weight as well as morphologically constricted uterine horns which
clearly suggests anti-estrogenic activity. Two isolated compounds from the rhizomes *A. galanga*, 1,7-bis (4-hydroxyphenyl)-1,4,6-heptatrien-3-one (BHPHTO) and bisdemethoxycurcumin (BDMC) were examined for their bioeffectivenesses on the human melanoma A2058 and showed that significantly inhibited the proliferation of melanoma cells in the cell viability assay. The research was also taken on the tests to B16-F10 cell line and showed minor inhibitory consequences of cellular tyrosinase activities and melanin contents.

**Antiulcer**

The effect of *A. galanga* ethanolic extract has been studied on experimentally induced gastric ulcers in rats and the findings suggest that a significant antisecretory and cytoprotective action of *A. galanga* may be responsible for its antiulcer activity.

**Antioxidant**

Ethanolic extracts obtained from Holy basil (*Ocimum sanctum* Linn) and Galangal (*Alpinia galanga*) showed strong antioxidant activity, acts as radical scavenger and also as lipoxygenase inhibitor. Mahae and Chaiser, studied antioxidant activities and antioxidative components in extracts of *A. galanga*. They reported 50% ethanol in water has antioxidant activity when compare with two other samples based on a water extract and the essential oil which determined using the 2, 2-diphenyl-1-picrylhydrazyl (DPPH) and oxygen radical absorbance capacity (ORAC) methods. The ethanolic extracts showed the highest DPPH free radical scavenging ability as well as the highest ORAC value when compared to the water extract and the essential oil.

**Anti inflammatory**

*Alpinia galanga* have anti-inflammatory and analgesic effects towards rheumatic condition. It acts as therapeutical agent for treating inflammatory immune disorders and induced paw inflammation and granuloma weight. Furthermore, it shows drastic significant effect on reducing symptoms of osteoarthritis. Phitak et al., reported the effects of p-hydroxycinnamaldehyde from A. galanga acetone extracts on human chondrocytes. Osteoarthritis (OA) is the most common form of arthritis and affects millions of people worldwide and patients have traditionally been treated with non-steroidal anti-inflammatory drugs (NSAIDs), but these are associated with significant side effects.
Anticancer
The active compound, 1’S’-1’-acetoxychavicol acetate were found to provide inhibition of the growth of oral squamous cell carcinoma in in-vitro or in-vivo besides potentiating the effect of synthetic drug- cisplatin. Batra et al., reported that 1’-acetoxychavicol acetate inhibits the NF-kB activation and demonstrates the suppression on the generation of tumor in the mice.

stomachache
A. galanga has been used as a medicine for curing stomach aches in China and Thailand.

Treatment of HIV
Methanolic extract of A. galanga showed potent inhibitory activity against human immunodeficiency virus type-1 (HIV-1) and human cytomegalovirus (HCMV).

hypolipidemic activity
The ethanolic extract of A. galanga is reported to possess hypolipidemic activity. A dose of 20 mg/day of the extract was given for the period of 4 weeks to the rats and results in the reduction in the serum and tissue levels of total cholesterol, triglycerides, and phospholipids significantly increased the serum levels of high density lipoproteins (HDL) in rats. Effects of extract on lipid profile exhibited the efficacy of A. galanga in lowering the risk of arteriosclerosis.

Insecticidal Activity: Alpinia galanga was found to exhibit insecticidal activity in previous studies. Hexane crude extract of A. galanga gave the highest control efficiency to adult Bactrocera dorsalis compared to dichloromethane, ethyl acetate and 95% ethanol. Thus, this extract may an alternative way for control this insect pest in the future.

Anti Diabetic
Akhtar, M. S. et al (2002) studied hypoglycaemic activity of Alpinia galanga rhizome and its extracts in rabbits the investigation was carried out to study effects of Alpinia galanga rhizome on blood glucose levels. In normal rabbits, powdered rhizome and its methanol and aqueous extracts significantly lowered the blood glucose.

Antiallergic: Alpinia galanga was found to be effective in treatment of allergy and the isolated compounds which extract inhibit the release of antigen IgE mediated in passive cutaneous anaphylaxis reactions in mice.
CONCLUSION
The extensive literature survey revealed that *Alpinia galanga* is important medicinal plant with diverse pharmacological spectrum. The plant shows the presence of many chemical constituents which are responsible for varied pharmacological and medicinal property. The evaluation needs to be carried out on *Alpinia galanga* in order to uses and formulation of the plant in their practical clinical applications, which can be used for the welfare of the mankind hence it can be called as LIFE SAVING DRUG.

REFERENCES
5. Verma k Ramesh,Mishra Garima,Singh pradep,Jha k k,Alpinia galangal An important medicinal plant a review-2011
6. Ram P. Rastogi, B.N. mahrotra, Compendium of Indian Medicinal Plant. CDRI & National Institute of Science Communication and Information, New Delhi, IV, 6-37


