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A review on khulanjan (*Alpinia galanga*) with special reference of Unani medicine

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Abstract
Alpinia galanga belongs to family Zingiberaceae commonly known as *Khulanjan* and also mentioned as *Tigliyoonin* in Unani classical literature. It is used in various unani formulations such as *Habbe Jadwar, Jawarish Jalinoos, Arq Khulanjan* etc. It has been used by Unani physicians since ancient times for the treatment of various ailments such as *Bakhrul Fam* (Ozostomia), *Nafkh-e-shikam* (Flatulance), *Waj-ul-Mafasil* (Arthritis), *Zeeq-un-Nafas* (Asthma), *Salsul Baul* (Incontinence of Urine). The main constituents identified in the rhizome are 1, 8-cineole, fenchyl acetate and β–pinene. Diverse pharmacological studies of *Khulanjan* have been reported to prove its *Mufarreh* (Exhilirant), *Mutayyib-e-Dehan* (Aromatic), *Muhallil-e-Auram* (Anti-inflammatory), *Musakkin* (Analgesic) and *Kasir-e-Riyah* (Carminative) property. This review summarizes the information described in classical Unani text and scientific research conducted on different parts of *Khulanjan* plant.

Keywords: *Alpinia galanga*, *Khulanjan*, Rhizome, Unani, Quercetin

1. Introduction
In ancient times practitioners used to make their own drug preparations on small scale as per the need of patient. But in present scenario an increased demand has been observed in the field of alternative medicine, patients are reverting back to the natural remedies due to its natural origin and lesser side effects [1]. Herbal preparations are now being manufactured on large scale by herbal drug industries, but manufacturers are facing lot of problems related to drug authentication and supply of unadulterated raw material [2]. Therefore, exploring the ancient literature to find out detailed information of crude drugs and their related side effects is the current challenge for the scientists. *Alpinia galanga* is commonly known as *Khulanjan* and belongs to family Zingiberaceae. *Khulanjan* is used both as single drug (*mufrad dawa*) and in the form of compound drug (*murakkab dawa*). It is found all over the world. Different parts of this plant are used for the treatment of various disorders.

1.1 Taxonomical Classification [3, 4]

Table 1

Kingdom	Plantae
Order	Zingiberales
Family	Zingiberaceae
Subfamily	Alpiniodeae
Genus	Alpinia
Species	*Alpinia galangal*

1.2 Vernacular Names [3, 5]

Table 2

English	Greater Galangal, Java galangal
Arabic	Khowlanjan, Khulanjan
Persian	Khurduwara, KhusraVedurekalan
Urdu	Kulanjan, Khulanjan,paanki jar
Hindi	Barakalijan, Kulanjan
Sanskrit	Aruna, Dhumala, Gandhamula
Tamil	Anandam, Arattai, Tittiram
Telgu	Dumparashtrakamu, Kachoramu
Malyalam	Aratta, Chitta-ratta, Pera-ratta
Kannada	Dambarasme

1.3 *Mizaj* (Temperament)
Hot 3° Dry 3° [6]
Hot 2° Dry 2° [7]

1.4 *Muzir* (Adverse Effects)
Habis-e Baul (Retention of urine) [6, 8, 9]
Muzir-e-qalb (Cardiac toxicity) [10]

1.5 *Musleh* (Correctives)
Sandal Sufaid (*Santalum album Linn*.), Anisoon (*Pimpinella anisum Linn*.), Tabasheer (*Bambusa arundinacea*) [9]
Kateera (*Sterculi aurens Roxb*.) [3, 10]

1.6 Controversy
Nil

1.7 *Badal* (Substitute)
Darchini (*Cinnamomum zeylanicum blume*) [3, 10]
Qaranphal (*Myrtus caryophyllus*) [10, 11]
Kababchini (*Piper cubeba*) [3, 10]

1.8 *Miqdar-e-Khurak* (Dosage)
2 - 3g [4]
3.5-6.75g [10]

1.9 *Mazah* (Taste)
Spicy

1.10 *Muddat-e-Hayaat* (Shelf Life)
7 years [10]

1.11 Part Used
Rhizome

1.12 Procedure and Time of Collection
Rhizome of the drug should be collected in late summer or early autumn and should be washed trimmed out in segments and dried carefully.

1.13 Preservation and Storage
It should be kept in air tight container and dry place.

2. Botanical Description
2.1 Habitat
Exact origin of *Galanga* is unknown but it is inhabitant of Indonesia, it has become adapted in many parts of South and South East Asia, because of its high medicinal value. Its volatile oil magnetizes more international interest. Some old reports showed its use in Southern China and Java. It is used in south East Asia as a daily household spice, so that it can easily cultivated in kitchen gardens of these areas. Along with Indonesia and Thailand, India is the chief supplier for *Alpinia galanga*. In India its presence mainly recorded at Himalayan region of Bihar, West Bengal and Assam. It proves enthusiastic development along the eastern Himalayas and in southwest India and is cultivated all over the Western Ghats [12, 13].

2.2 Macroscopic Description
Alpinia galanga is a rhizomatous strong, perennial herb, rising up to 350 cm tall, with a profound, profusely branched, creeping and aromatic rhizome. The rhizomes are externally reddish brown with thickness 2.5–10.0 cm, and internally light orange–brown. There is erect aerial leafy stem (pseudo-stem), produced by the rolled leaf sheaths. Leaves are 23–45 by 3.8–11.5 cm, distichous, alternate, glabrous and oblong–lanceolate. The inflorescence is a terminal many-flowered raceme, flowers having good smell, 3–4 cm long, yellow-white, the fruit is a globose to ellipsoidal capsule, 1–1.5 cm in diameter, orange-red to wine red. Its smell is like a blend of black pepper, taste is bitter and spicy [14, 15].

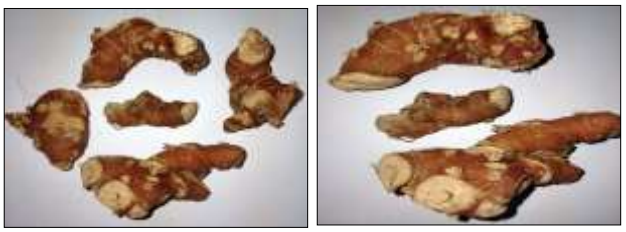

Fig 1: Rhizome of *Alpinia galangal (Khulanjan)*

2.3 Microscopic Description
Transverse section of rhizome shows the particular thick walled endodermis that partitions the entire rhizome into cortical locale and inward ground tissue. The epidermis comprises of single layered circle to oval, slim walled parenchymatous cells with thick external dividers and running from 54-86 x 22-45 μ. The cortex normally includes a few layers of oval to rectangular, 121-148 μ long and 89-113 μ in width, dainty walled parenchymatous cells and the greater part of these cells contain starch and oleo-resin. There are various firmly dissipated vascular packs, which are totally sheathed in the cortex, among the important diagnostic feature. The vascular group is encased inside a sheath of 3-4 layers of filaments which is collateral in nature. Endodermis structures a consistent ring having rectangular to polygonal cells of which external wall is highly lignified. The vascular packages just underneath the endodermis are relatively more near one another shaping right around a ring. Ground tissue includes oval to rectangular, dainty walled parenchymatous cells; a couple contain starch grains and oleo-resins, which are somewhat elliptical or oval and 8-54 μ in breadth [15, 16].

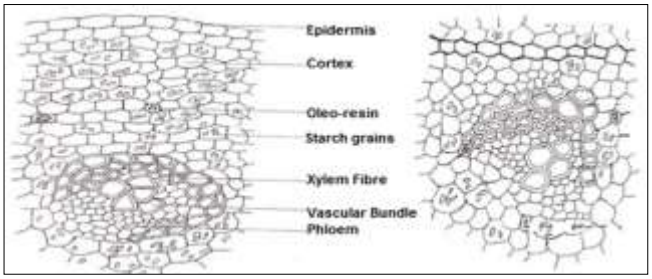

Fig 2: Transverse Section of Rhizome of *Alpinia galanga (Khulanjan) (Courtesy; P. Akhtar et. al., 2010)*

3. Phytochemistry
Alpinia galanga consist of glycosides, carbohydrates, resins, magnesium, phosphate and sulphate. The leaf oil contained 1, 8-cineole, -pinene and camphor as major constituent. Root of *Alpinia galanga* contains 3 different compounds namely galangin, campheride, analpinin. Volatile essential oil is obtained that has a pleasant odour and it contains 7 chemical components viz methyl cinnamate, cineole, 1-camphene, 1- borneol, methyl chavicol, cargene and α-pinene [17, 19].

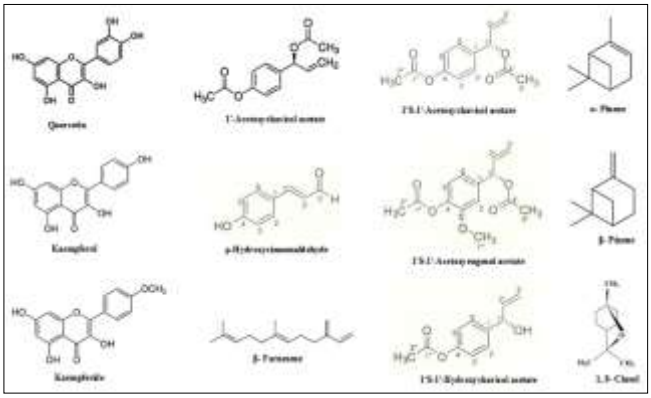

Fig 3: Chemical structures of few important constitutents present in *Alpinia galanga (Khulanjan)*

4. Pharmacological Actions [6, 9, 10]

- **Main action:** *Muqawwi-e-Qalb* (Cardiotonic)
- *Mufarreh* (Exhilirant)
- *Mutayyib-e-Dehan* (Aromatic)
- *Muhallil-e-Auram* (Antiinflammatory)
- *Musakkin* (Analgesic)
- *Kasir-e-Riyah* (Carminative)
- *Munaffis-e-Balgham* (Expectorant)
- *Muqawwi-e-Meda* (Stomachic)
- *Muqawwi-e-Baah* (Aphrodisiac)
- *Mudir-e-luab* (sialogogue)
- Fly repellent

5. Pharmacological Uses [6, 10]

- *BakhrulFam* (Ozostomia)
- *Nafkh-e-shikam* (Flatulance)
- *Waj-ul-Mafasil* (Arthritis)
- *Zeeq-un-Nafas* (Asthma)
- *Salsul-Baul* (Incontinence of Urine)
- *Beht-us-Saut* (Hoarseness of Voice)
- *Zof-e-Baah* (Sexual Disability)
- *Namsh* (Freckles)
- *Siqlul-lisaan* (Heaviness of tongue)
- Delayed speech in babies
- *Luknat* (Stammering)

6. Method of Use

- **Oral:** *Habb* (tablet), *Safoof* (Powder) (2.25-3.5 gm mixed with 420ml or 35ml cow milk) [10]
- **Local Application:** Make thick paste by adding water or olive oil [10]
- Fine powder is rubbed over tongue [3]

7. Pharmacological Studies

The different pharmacological activities possessed by *Alpinia galanga* and various studies performed on different parts of *Alpinia galanga* were summarized in Table 3.

Table 3: Different pharmacological activities possessed by *Alpinia galanga (Khulanjan)*

Activity Possessed	Published Literature
Anti-bacterial activity	Kiranmayee Rao. *et al*., 2010 recommended *Alpinia galanga* as suitable source for the development of new generation drugs [20]. Rini, C.S. *et al*., 2018 found its effective antibacterial activity in *Bacillus subtilis* bacteria and *E. coli* [21]. Similarly Dan Zhang *et al*., 2019 showed the strongest activity against different strains of antibiotic-resistant *S. aureus*, and consider it suitable to use as antibiotic's alternative in animal feeding [22].
Anti-cancerous activity	Lakshmi, S. *et al*., 2019 demonstrate the synergistic interaction of chrysin with cyclophosphamide in terms of reducing the tumor size and increasing the lifespan of mice compared with the individual treatments [23]. According to current research by Faradiba Nur. *et al*., 2020 *Alpinia galanga* can be used as co-chemotherapeutic agent [24].
Analgesic activity	K. R. Subash. *et al*., 2018 showed analgesic activity of *Alpinia galanga* extract in mice [25].
Anti-amoebic activity	Nongyao Sawangjaroen. *et al*., 2006 found the anti-amoebic activity of *Alpinia galanga*. It was assumed that the essential oils present in *Alpinia galanga* are mainly responsible for its typical odour in addition to their reported use in (folk) medicine, which is responsible for their anti-amoebic activity [26].
Antioxidant activity	Nopparat Mahae *et al*., 2009 showed that ethanolic extract of *Alpinia galanga* have potential to be used as a natural antioxidant in food products [27]. Poh. bee *et al*., 2000 found that galangal extract may be a possible natural antioxidant source for meat and meat products [28]. Xixuan. Tang *et al*., 2018 focussed on antimicrobial and antioxidant property of galangal flowers and consider them better to used as natural food preservatives or as therapeutic agents [29]. J. C. Hanish *et al*., 2011 investigated the effect of the ethanol extract of *Alpinia galangal* (EAG) on oxidative stress by inducing Alzheimer's type amnesia in mice. It was observed that the elevated levels of acetylcholinesterase and monoamine oxidase enzymes in mice were attenuated by treatment with EAG. The generation of free radicals was decreased due to increased activity of antioxidant enzymes after treatment with EAG [30].
Anti-helmintic activity	Babu. N.D. *et al*., 2017 suggested better Anti-helmintic activity of Alpinia *galanga* [31].
Anti-microbial activity	M.Cadet. *et al*., 2013 found anti-microbial efficacy of *Alpinia galanga* (Linn.) and concluded that Galangal extract had no adverse effects on objects color and pH [32]. Jirwaan. *et al*., 2006 The ethanol extracts of galangal, were evaluated for antimicrobial action on *Staphylococcus aureus* 209P and *Escherichia coli* NIHJ JC-2. It was observed that the galangal extract had the strongest inhibitory effect against *S. aureus* [33].
Anti-ulcer activity	S. Qureshi. *et al*., 1994 showed anti-ulcer activity in rat model. An ethanol extract of *Alpinia galanga* was administered to mice. *Alpinia galanga* treatment significantly reduced their effect without affecting cytotoxicity. Biochemical changes caused by CP-treatment in the liver of treated animals were also significantly inhibited by *Alpinia galanga* treatment [34]. M.A.Al Yahya *et al*., 1980 The ethanolic extract of *Alpinia galanga* at a dose of 500 mg/kg, significantly reduced the intensity of gastric mucosal damage induced by pyloric ligation and hypothermic restraint stress in rats. Findings are suggestive to be due to antisecretory and cytoprotective action of *Alpinia galangal* [35].
Anti-leishmanial activity	Amandeep Kaur *et al*., 2010 showed anti-leishmanial activity of *Alpinia galanga.* Isolated constituents of Hexane, chloroform and ethyl acetate extracts (100microg/ml) of *Alpinia galanga.* rhizomes exhibited significant activity in vitro against promastigotes of *L. donovani* [36].
Anti-inflammatory	Subash. K.R *et al*., 2016 showed anti-inflammatory activity in rat model. *Alpinia galanga* root extract was prepared by

activity	using absolute alcohol and distillation in a Soxhlet apparatus. *Alpinia galanga* has probably acts by blocking histaminic and serotonin pathways [37].
Anaesthetic activity	Khumpirapang. N. *et al*., 2018 showed the anaesthetic activity of *Alpinia galanga* oil (AGO) in *Cyprinus carpio* (koi carp) fish model. Na+/K+-ATP ase α 3 were significantly reduced after exposure to AGO indicating the advantages of AGO on fish stress reduction. AGO is considered to be a promising natural source for an alternative fish anaesthetics [38].
Neuroprotective activity	Mundugaru. R. *et al*., 2018 designed this study to screen the neuroprotective role of hydroalcoholic extract of rhizome of *Alpinia galanga* (HAAG) in transient forebrain ischemia induced neuronal damage and oxidative injury in the rat brain. *Alpinia galanga* found to be neuroprotective against ischemic hippocampal injury [39].
Organogenesis activity	Kiranmayee. Rao *et al*., 2011 recommends *Alpinia galanga* as easily stored and transported drug with essential micropropogation [40]. K.M. Shamsudheen, *et al*., 2018 successfully developed a rapid shoot multiplication system via rhizome buds of *Alpinia galanga* and for shoot multiplication cytokinins BAP and TDZ were used. It serve as a good study source for large scale multiplication and in-vitro conservation of *Alpinia galangal* [41].
Psychostimulant activity	Shrivastava. S. *et al*., 2017 *Alpiniagalanga* with caffeine impedes the caffeine crash and improves sustained attention at 3 hours. These stimulant effects might give way for *Alpinia galanga* to be used as a key ingredient in energy drinks or similar products [42].
Hepatoprotective activity	Hemabarathy. B. *et al*., 2009 observed the hepatoprotective effect of the crude extract of *Alpinia galanga* at 200 and 400 mg kg-1 against paracetamol induced hepatotoxicity in rats [43].
Hypoglycaemic activity	Akhtar. M.S. *et al*., 2009 used aqueous and methanol extracts of *Alpinia galanga* to show its hypoglycaemic effects. Polysaccharides present in the rhizomes are known to increase the serum insulin levels, reduce the blood glucose levels and improve glucose tolerance [44].
Nephroprotective activity	Kaushik. P. *et al*., 2013 demonstrated significant nephro-protective activities in diabetes-induced nephropathy in rat model [45].
Immunomodulator activity	Jain A.P. *et al*., 2012 examined immunomodulatory activity of *Alpinia galanga* by T cell proliferation, splenocyte proliferation and by delayed type hypersensitivity reaction measurement in rat model. The flavonoid fraction of *Alpinia galanga* extract significantly stimulated (P <0.001) T cell proliferation and splenocyte proliferation due to presence of quercetin [46].

8. Compound Formulations Available [3, 9, 10]

Solid form: *Habbe Jadwar, Habbe Hilteet,*

Semi solid form: *Jawarish Jalinoos, Majoon Salab, Majoon Seer Alwi Khan, Majoon Samq, Majoon Khadar, Majoon Muqawwi Wa Mumassik, Halwa Saalab, Lauq Surfa, Laboob Sager Wa Laboob Kabeer, Mufarreh Motadil.*

Liquid form: *Arq Khulanjan, Arq Paan*.

9. Conclusion

Alpinia galanga has been reported to have valuable therapeutic properties. Rhizomes are prescribed mainly to treat *Bakhrul-Fam* (Ozostomia), *Nafkh-e-shikam* (Flatulance), *Waj-ul-Mafasil* (Arthritis), *Zeeq-un-Nafas* (Asthma), *Salsul-Baul* (Incontinence of Urine). It has been used since years in Unani system of medicine for its Anti-ulcer, Anti-inflammatory, Anti-amoebic property etc. Still very limited research has been carried out on other pharmacological activities of *Alpinia galanga*. Hence, this is challenging area for the scientists to explore its medicinal value. Further investigations are required to isolate and characterize the specific active components of *Alpinia galanga*, along with validation of the properties which are already mentioned in ancient literature. Recommendations are on intense and thorough research on *Alpinia galanga* in upcoming days to identify the imminent medicinal values.

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