

Review

Comprehensive review on ethnomedicinal, phytochemistry and pharmacological profile of *Ficus Religiosa L.*

Rahul Rawat, Harish Kumar, Neetu Singh, Aakash Deep, Balasubramanian Narasimhan, Surender Singh Yadav, Sanjiv Kumar

Rahul Rawat, Harish Kumar, Aakash Deep, Sanjiv Kumar, Department of Pharmaceutical Sciences, Chaudhary Bansi Lal University, Bhiwani 127021, India**Neetu Singh, Surender Singh Yadav**, Department of Botany, Maharshi Dayanand University, Rohtak 124001, India**Balasubramanian Narasimhan**, Faculty of Pharmaceutical Sciences, Maharshi Dayanand University, Rohtak 124001, India**Correspondence to: Dr. Sanjiv Kumar**, Department of Pharmaceutical Sciences, Chaudhary Bansi Lal University, Bhiwani 127021, India. sanjiv.pharmsci@gmail.com

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Abstract

Ficus religiosa L. (F. religiosa) or sacred fig is a large perennial tree belonging to the family Moraceae or mulberry family. Though the tree has pan-tropical distribution but originally it is indigenous to the Indian subcontinent and Indochina region. Popularly the tree is named "Peepal or bodhi tree". Traditionally, it is practiced for the treatment of asthma, nose bleeding, heart disorders, diabetes, wound healing, ear problems, constipation, hyperlipidemia, gonorrhea, ulcers and infectious disorders. Chemical analysis demonstrated the presence of numerous bioactives including tannins, phenols, saponins, sugars, alkaloids, methionine, terpenoids, flavonoids, glycosides, proteins, separated amino acids, essential and volatile oils and steroids etc., which are probably responsible for its diverse pharmacological actions. The present work is an attempt to compile up-to-date comprehensive information on *F. religiosa* that covers its taxonomy, ethnomedicinal importance, phytochemistry, pharmacological attributes and clinical trials. Keeping in mind the various health attributes of *F. religiosa*, future research can be aimed at in-depth elucidation of the structure-function relationship and multifactorial signaling pathways.

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Keywords: *Ficus religiosa*; phytoconstituents; pharmacology; clinical trials; ethnomedicine; health benefits**1. INTRODUCTION**

Natural products of botanical origin obtained from wild

plants, spices, weeds, cultivated plants are widely used to treat about 87 % of all categorized health impairments including immunological disorders, cardiovascular disorders, neurological disorders, diverse pathological infections, wounds, diabetes and cancer etc. Besides, natural bioactives also pose a halt to the process of pathogenesis.¹ In this regard, more than 3000 species of plants are well recognized that possess excellent therapeutic potential. In developing nations, about 80% of the population highly depends upon plant-based natural products for their primary health care needs.² Apart from this, they are also used to produce dyes, cosmetics and medicines. Owing to their excellent therapeutic benefits, natural products have played a key role in improving the quality of human well-being. These medicinal attributes of plant-based natural products are also well designated in Ayurveda i.e. one of the oldest traditional systems of medicine in India. Eastern medicine began predominantly in Asia; which identifies with a number of medical operations that use a wide range of "natural" therapies, including homeopathy, herbalism, acupuncture, and therapy for diet and way of life.³

Ficus religiosa L. (F. religiosa) is one of the most popular plants that exhibit numerous religious and health benefits. *Ficus religiosa L.* contains different types biological activities i.e. antidiabetic activity,⁴ antimicrobial activity,⁵ Analgesic activity,⁶ Acetylcholinesterase inhibitory activity.⁷ There are more than 800 species and 2000 varieties in the genus *Ficus*, most of which are native to old world tropics. *Ficus benghalensis* (Banyan tree), *Ficus religiosa* (Peepal tree) and *Ficus carica* (Anjir tree) are some of the commonly occurring trees of this genus belonging to the family Moraceae. The peepal tree is regarded as a sacred tree to Hindu and Buddhist culture. It has got religious, mythological, and medicinal importance in Indian culture since time immemorial. The word '*Ficus*' is originally originated from the Latin word 'Fig' which means the fruit of the tree whereas 'religiosa' refers to 'religion' that reflects sarcasm of plant in both Hinduism and Buddhism and by which the plant is very frequently planted in temples. The plant acts as an excellent rejuvenator and helps in relieving stress. Owing to its great medicinal importance, the plant is also included in

the Indian traditional system of medicine i.e. Ayurveda. In Ayurveda, it comes under a class of drugs known as Rasayana. Rasayana drugs act in the human body by modulating the neuro, endocrine and immune system. These drugs are found to be a rich source of antioxidants.⁸ On a traditional scale, local healers and traders recommended this plant for curing various health ailments. The pharmacological evaluation also reported the use of ficus bark and leaves in combating microbial infections, diarrhea, ulcer, gonorrhea, skin ailments as well as astringent agent.^{2,9-12} Fruits are used to treat asthma and as laxatives agents, whereas latex is used as a tonic.¹³ In this respect, an attempt has been tried to club all relevant information regarding the various herbal formulations, phytochemistry and pharmacological attributes of *F. religiosa*. Furthermore, the clinical aspect of the respective tree is also highlighted.

2. METHODOLOGY

Extensive literature was retrieved by surveying different worldwide accepted major databases like Google Scholar, Scopus, Science Direct, Wiley, PubMed, Elsevier and Web of Science. Relevant information was also clubbed from the thesis, recognized books and abstracts. Some articles were also tracked through sub-referencing the primary publications or citations by directly accessing the journal websites. The information on its botany, traditional importance, distribution and common names was also obtained from local as well as published books along with google chrome. The botanical name of the respective plant was authenticated from The Plant List (<http://www.theplantlist.org/>). For gathering sufficient information on the proposed plant following keywords viz. *Ficus religiosa*, pepal, ethnomedicinal, ethnopharmacology, phytochemical analysis, pharmacology were used,⁷ Analgesic activity.⁶

3. BOTANICAL DESCRIPTION

Habitually, the bodhi tree is a semi-evergreen tree that

attains the height of up to 98 ft and a trunk of about 9.8 ft.¹⁴ It is a large-sized tree with heart-shaped leaves and purple fruit growing in pairs. It is usually epiphytic with the drooping branches having long-petiole, ovate, or cordate shiny leaves. Leaves are bright green. They are about 10-17 cm long and 8-12 cm broad with a 6-10 cm petiole. The apex dropped into a linear-lanceolate end as the foremost portion of the leaf. The bark is flat or slightly curved, varying from 5 to 8 mm in thickness. The outer cover is grey in coloured with membranous layers and oftentimes it is also covered with brown or ash-colored crustose lichen surface. The fruits are small figs, occurred in pairs, 1-1.5 cm in diameter and are green to purple. Flowers are positioned as axillary sessile and are unisexual. Based on morphological characteristics, Banyan trees can be distinguished into male and female trees.¹⁵ The different plant parts of *F. religiosa* are depicted in Figure 1.

3.1. Taxonomic

Taxonomy gives a detailed overview of various morphological and anatomical structures of a plant species. *F. religiosa* L. plant belonging to the family Moraceae and is commonly known as 'Peepal tree'. The taxonomic classification of *F. religiosa* is given as follows:

Domain: Eukaryota; Kingdom: Plantae; Subkingdom: Viridaeplanta; Phylum: Tracheophyta; Subphylum: Spermatophytina; Infraphylum: Angiospermae; Class: Magnoliopsida Brongniart; Subclass: Dilleniidae; Superorder: Urticales; Order: Urticales; Family: Moraceae; Division: Magnoliophyta; Tribe: Ficeae; Genus: Ficus; Specific epithet: Religiosa.

3.2. Common names of *F. religiosa*

The plant has different names in different languages. In India, it is commonly known as Peepal in Hindi, Asvatthah in Sanskrit, Arayal in Malayalam, Sacred fig in Bengali, Arasu in Tamil and Ravi in Telugu.¹⁶ Besides

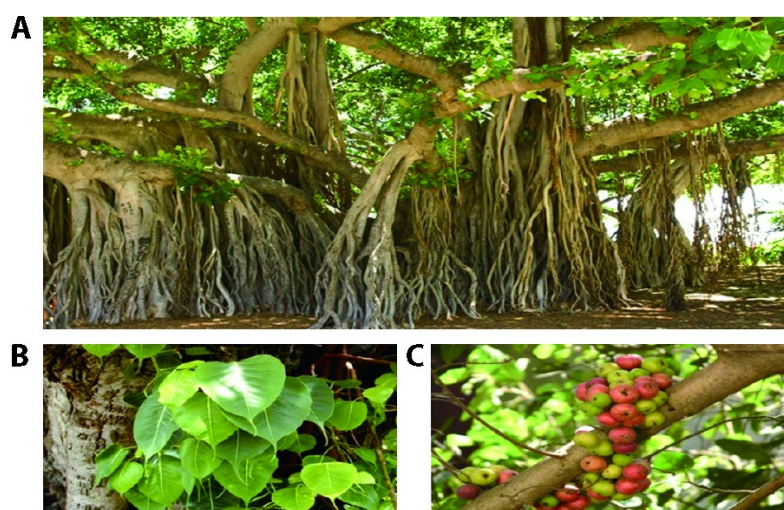


Figure 1 Different plant parts of *F. religiosa*
A: whole tree; B: leaves; C: fruits.

these common names, the same plant is called by several other names too as discussed below: Indian: Papal, pipul; Chinese: Putishu; Arabic: Teen mukadas, teen Asnam, shajaratbebal, ficusabulesan; English: Botree, peepul tree, sacred fig; French: Arbre de dieu, figuier de pagodes; German: Bobaum, heiligerfeigenbaum, indischerpepulbaum, pepulbaum; Italian: Fico del diavolo; Portuguese: Figueira-dospagodes, figueira-religiosa; Spanish: Higuera de agua; Swedish: Tempelfikus.

3.3. Geographical distribution

Plant *F. religiosa* is a long-lasting tree with an average life span ranging between 900-1500 years. It grows at sea plain heights ranging from 33 to 4990 ft. *F. religiosa* is widely planted in the tropics. It is also cultivated by plant nurseries for use as an ornamental tree, in gardens, temples and parks in tropical and subtropical climates.¹⁷ It is also cultivated as an ornamental, for medicinal uses, such as toothaches, and in the making of shellac. Plant *F. religiosa* is endemic to Asia-tropical regions including Bangladesh, India, Nepal, Pakistan, China, Myanmar, Thailand, Vietnam and Iraq etc. The plant natively belongs to tropical Asia i.e. China, India, Nepal and Thailand. Nowadays, it has also been introduced, spread and cultivated throughout the whole world. Ecologically, it is scattered in forests, where it propagates as an epiphyte on other trees.¹⁸

4. ETHNOMEDICINAL PRACTICES

Plant *F. religiosa* possesses numerous health benefits and is widely utilized for the preparation of various food products and herbal formulations.¹⁹ Traditionally the bark of this plant is used as an antibacterial, antiprotozoal, astringent, antidiarrhoeal, in the treatment of gonorrhea, ulcers and the leaves used for skin diseases.¹⁰ Some food products and herbal remedies are prepared using *F. religiosa*.

5. PHYTOCHEMICAL ANALYSIS

F. religiosa is a rich reservoir of various active compounds. The preliminary phytochemical analysis revealed that the plant contains tannins, phenols, saponins, sugars, alkaloids, methionine, terpenoids, flavonoids, glycosides, proteins, separated amino acids, essential and volatile oils and steroids in good amount.^{8,16,20-23} The various phytochemical constituents obtained from different parts of *F. religiosa*.

6. PHARMACOLOGICAL ACTIVITIES

Pharmacology is science-oriented research dealing with the characterization, evaluation of drugs and their action in different biological systems. It also evaluates the impact of drugs in treating different disorders too. The diverse pharmacological effects rendered by different parts of *F. religiosa* have been discussed as follows.

6.1. Antidiabetic activity

Pandit *et al*⁴ evaluated the aqueous extract of *F. religiosa*

for its anti-diabetic activity in glucose loaded hyperglycemic and streptozocin induced diabetic rats. Three different doses i.e. 25, 50 and 100 mg/kg of the extract were screened against the standard drug glibenclamide (10 mg/kg) and the effect was compared. In another study, Pochhi and Muddeswar (2017) investigated the hypoglycemic effect of aqueous leaves extract of *F. religiosa* in alloxan-induced diabetic rats. The animals were divided into 5 groups and were orally administrated with an aqueous extract of *F. religiosa* at a dose of 250 mg/kg for 21 d. Tolbutamide was used as a standard drug.²⁴

6.2. Antimicrobial activity

Prakash *et al*⁵ studied the antimicrobial activity of aqueous and methanolic extract of *F. religiosa* leaves. The extracts were screened for their antimicrobial activity against *E. coli* using agar well diffusion method. The results were compared with control drug (standard antibiotic streptomycin). It was observed that the extracts possess significant antimicrobial activity. Tulasi *et al*²⁵ collected the latex of *F. religiosa* and extracted with four different solvents i.e. hexane, chloroform, *n*-butanol and aqueous. The extracts were screened for their antimicrobial activity against five different microbial strains (*E. coli*, *B. subtilis*, *K. pneumonia*, *S. aureus* and *S. typhi*) and one fungal strain (*C. albicans*) using the agar well diffusion method. Four different doses i.e. 100, 50, 10 and 0.1 mg/kg of extracts were screened for antimicrobial potential and compared to standard antibiotics like streptomycin and nystatin at a dose of 10 µg/mL.

6.3. Analgesic activity

Sreelekshmi *et al*⁶ evaluated the methanolic bark extract of *F. religiosa* for its analgesic activity using acetic acid-induced writhing (extension of the hind paw) in mice model. Three different doses of extracts *viz.* 125, 250 and 500 mg/kg of the extract was screened and results were compared with standard drug Aspirin. Different treatment groups i.e. acetic acid control group, aspirin at a dose of 25 mg/kg and the bark extract at a dose of 250 mg/kg showed 32 ± 0.20 , 7.2 ± 0.70 and 9.1 ± 0.35 mean number of writhes in 20 min, respectively whereas 77.51% and 71.56% inhibition was shown by aspirin and extract at the same dose, respectively.

6.4. Anti-ulcer activity

Khan *et al*²⁶ evaluated the ethanolic bark extract of *F. religiosa* for its anti-ulcer efficacy using indomethacin cold restrained stress-induced gastric ulcer and pylorus ligation assay model. The extract was evaluated at three different concentrations of 100, 200 and 400 mg/kg and later the obtained results compared with standard drug Ranitidine used at a dose of 50 mg/kg. It was noticed that the extract possesses considerable antiulcer potential. Saha *et al*¹² studied the hydroalcoholic leaves extract of *F. religiosa* for its anti-ulcer potential using absolute ethanol along with aspirin at a concentration of 0.2 mL

and 200 mg/kg, respectively. The study was conducted on the pylorus ligation rat model. The extract was studied at two different dose levels i.e. 250 and 500 mg/kg and were noticed with significant results on comparison with standard drug ranitidine (used at a dose of 50 mg/kg). Gregory *et al*²⁷ evaluated the *F. religiosa* leaf ethanolic extract for its anti-ulcer activity using stress-induced ulcer animal models. The extract was examined at two different doses of 250 and 500 mg/kg. The results were compared with standard drug ranitidine (at a concentration of 50 mg/kg) and considerable results were obtained with the extract.

6.5. Wound healing activity

Roy *et al*²⁸ evaluated the hydroalcoholic leaf extract of *F. religiosa* for wound healing activity using excision and incision rat wound model. The rats were treated with 5% and 10% of extract ointment for 16 days and the result was compared with standard drug Povidone-iodine 5% (w/w). The extract showed good results for its wound healing activity. In another study, Murti *et al*²⁹ investigated the ethanolic root extract of *F. religiosa* for wound healing activity using excision and incision rat models. The extract was used on a 5% and 10% w/w basis for 16 d period and the results were compared with standard povidone-iodine 5% w/w ointment. The various significant results obtained from the above-mentioned studies are well clubbed.

6.6. Antioxidant activity

Charde *et al*³⁰ screened the ethanolic leaves extract of *F. religiosa* for antioxidant activity using 1,1-diphenyl, 2-picryl hydrazyl (DPPH) radical scavenging method. The extract was tested in five different concentrations of 200, 400, 600, 800 and 1000 µg/mL and it showed significant peroxide scavenging results. Kumar *et al*³¹ evaluated the ethanolic leaves extract of *F. religiosa* for its free radical scavenging activity by adopting various *in-vitro* models. The extract was investigated for its antioxidant activity by DPPH radical scavenging assay, hydrogen peroxide scavenging assay and reducing capacity assay. The results were compared with selected standard drugs.

6.7. Anti-Parkinson's activity

Bhangale *et al*³² evaluated the petroleum ether extract of *F. religiosa* leaves for anti-Parkinson activity using haloperidol-induced catalepsy and 6-hydroxydopamine (6-OHDA) induced Parkinson disease in rat models. The effects of the extract were evaluated at different concentrations of 100, 200, and 400 mg/kg. Results were compared with reference drug levodopa by measuring different neurochemical parameters *viz.* MDA, CAT, SOD and GSH etc.

6.8. Anti-asthmatic activity

Kapoor *et al*³³ studied the aqueous extract of *F. religiosa* leaves for anti-asthmatic activity. The study was conducted on histamine and acetylcholine-induced bronchospasm in the guinea pig model. The extract was

administrated at two different doses of 150 and 300 mg/kg and the results were compared with standard drug aminophylline at a concentration of 25 mg/kg. The significant results were noticed in extract supplementation. Ahuja *et al*³⁴ studied the methanolic extract of *Ficus* fruits for anti-asthmatic activity using histamine-induced bronchospasm in guinea pigs. The asthmatic effect was measured in terms of dyspnea. The extract was administrated at three different doses of 125, 250 and 500 mg/kg and the result was compared with standard drug ketotifen at a concentration of 1 mg/kg. The extract obtained significant anti-asthmatic results.

6.9. Anticonvulsant activity

Patil *et al*³⁵ evaluated the aqueous aerial root extract of *F. religiosa* using strychnine, pentylenetetrazol, picrotoxin (PCT) and isoniazid (INH) induced seizures mice model. Three different doses of the extract were used and the result was compared with the standard drug diazepam at a concentration of 1 mg/kg. The significant results were noticed with the extract. Singh *et al*³⁶ studied the methanolic extract of *F. religiosa* figs for anticonvulsant activity using MES, picrotoxin, and PTZ induced seizure in Swiss albino mice model. Three different dosages of extracts i.e. 25, 50 and 100 mg/kg were administered and the results were compared with standard drug Diazepam and phenytoin. The extract has shown good results.

6.10. Immunomodulatory activity

Gupta *et al*³⁷ evaluated the aqueous extract of *F. religiosa* leaves, stem and root for their immunomodulatory effect. The count of human blood cells including monocytes, lymphocytes and granulocyte was carried out through flow cytometry. Along with, Th1 tumour necrosis factor- α (TNF- α) type of cytokines of peripheral blood mononuclear cells were also observed. Different doses of different aqueous extracts *viz.* 0.5, 1, 10 and 30 mg/mL were screened for their immunomodulatory effect, and results were compared with control. Results showed a significant effect of variable doses of aqueous root extract as compared to other extracts. The root extract was better even at their lower concentrations and considerably enhanced the level of monocytes (at a dose of 0.5 mg/mL). The root extract also improved the level of TNF- α in peripheral blood mononuclear cells while a rapid decline was noticed in the level of monocytes and TNF- α with leaves and stem extracts even at their high dose of 30 mg/mL. Therefore, the root extract can be recommended as a good and safe immunomodulatory agent.

6.11. Anti-inflammatory activity

Viswanathan *et al*³⁸ evaluated the aqueous extract of *F. religiosa* bark for anti-inflammatory activity using carrageenan-induced paw edema in rat models. The different concentrations of extract including 25, 50 and 100 mg/kg were screened and results were compared with standard drug Phenylbutazone used at a dose of

100 mg/kg. The extract has shown significant results. Sreelekshmi *et al*⁶ evaluated the methanolic extract of *F. religiosa* bark for anti-inflammatory activity in carrageenan-induced paw edema in Wistar albino mice. Different concentrations including 125, 250 and 500 mg/kg were screened as compared to the standard drug indomethacin (used at a dose of 5 mg/kg). The significant results were obtained with the bark extract. Charde *et al*³⁰ studied the ethanolic extract of *Ficus religiosa* leaves for anti-inflammatory activity in carrageenan-induced paw edema in rats. The extract (at a dose of 300 mg/kg) was tested against standard drug ibuprofen (at a dose of 300 mg/kg) and the percentage inhibition of inflammation was noticed after 1, 2, 3, and 4 h and was calculated by newbould's method.

6.12. Acetylcholinesterase inhibitory activity

Vinutha *et al*⁷ studied the methanolic extract of *F. religiosa* bark for its inhibitory action on the acetylcholinesterase enzyme. The study was carried out by using acetylcholinesterase inhibition assay. The effect was screened at three different concentrations of extracts including 40, 60 and 80 µg/mL. Results obtained with extract were compared with Eserine hemisulphate (used as positive control). The extract has shown a significant IC₅₀ value of 73.69 mg/mL while the MI ± S.E.M value was 43.59 ± 0.41 and 52.60 ± 2.91 at the dose of 60 and 80 mg/mL, respectively.

6.13. Hepatoprotective activity

Suryawanshi *et al*³⁹ evaluated the *F. religiosa* bark extract for its hepatoprotective action. The study was conducted on paracetamol (2 g/kg) induced hepatotoxicity in rat models. The different solvents (aqueous, methanolic, ethyl acetate and petroleum ether extract) extracts were used at a single dose of 200 mg/kg and the results were compared with standard drug silymarin (used at a dose of 100 mg/kg). The significant results were noticed with methanolic and aqueous extracts. Parameswari *et al*⁴⁰ studied the effect of methanolic extract of *F. religiosa* for its hepatoprotective action on isoniazid-rifampicin and paracetamol-induced hepatotoxicity in male Wistar albino rats. Three different doses (100, 200, 300 mg/kg) of the extract were administered and their potential was compared with the standard drug Liv 52 and found that the extract possesses good hepatoprotective action. Selvan *et al*⁴¹ evaluated the methanolic and aqueous extract of *F. religiosa* bark for hepatoprotective potential in paracetamol and carbon tetrachloride-induced hepatotoxicity. Both the extract was given a dose of 200 mg/kg and the results were compared with the standard drug (Silymarin 100 mg/kg).

6.14. Anti-diarrheal activity

Panchawat *et al*⁴² evaluated the acetone extract of *F. religiosa* bark for its anti-diarrheal activity. The study was conducted on castor oil-induced diarrhea in rat models. The extract was administered at a dose of 200 mg/kg and

results were compared with standard drug loperamide. The total number of diarrhoeal feces and percentage protection obtained within 4 h of extract treatment was 9.16 ± 0.40 and 55.15%, respectively whereas the consistency of feces was found to be semisolid with lumps. The total number of diarrhoeal feces and percentage protection obtained within 4 h was 7.33 ± 0.33 and 72.42%, respectively on treatment with standard (castor oil + loperamide) while the consistency of feces was solid. The results obtained with standard and extract were comparable so that ficus extract can be suggested for the treatment of diarrhea.

7. CLINICAL TRIALS AND SAFETY

Traditionally every part of *F. religiosa* is used for various home remedies and herbal formulations. Pharmacological activities of *F. religiosa* have also proven the diverse effects of this plant in many health impairments. Clinical trials play an important role in justifying these pharmacological effectiveness of *F. religiosa*. *Ficus religiosa* is safe to use because there have been no reported side effects from ancient times till now. Methanolic extract was tested for acute toxicity in swiss albino mice and found to be safe. No neurotoxicity was reported in the mice. Before using the formulation of plant: (a) Read the label and instructions carefully. (b) Do not exceed the recommended dosage. (c) When taking medicine, avoid any harsh odor in your mouth. (d) Keep in a cool and dry place.⁴³

8. CONCLUSION

The present review describes the morphological, phytochemical, ethnomedicinal, pharmacological and clinical aspects of *F. religiosa*. After analyzing the whole study, it can be concluded that all parts of *F. religiosa* possess a good health-improving potential and they can be utilized safely to treat wounds, asthma, flatulence, constipation, ear problems, nose bleeding, oral diseases, skin problems, jaundice, mumps, urinary disorders, fever and flu. Some of its ethnomedicinal attributes have also been validated by its numerous pharmacological studies with its different extracts. Unfortunately, the available pharmacological research is still lacking to prove these therapeutic potentials. However, the available information revealed the various pharmacological actions of different plant parts and can be efficiently used to treat wounds, diarrhea and liver disorders. Numerous bioactives present in different plant parts are most likely to be responsible for its diverse pharmacological actions. Owing to its diverse therapeutic value, there is further need to elucidate in-depth multifactorial signalings pathways, structure-function relationships. Moreover, placebo trials and toxicological research are also needed for the long-term effects of this plant on target organs concerning its specific pharmacological action.

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