

Phytochemical and Pharmacological Profile of *Echinops echinatus* Roxb. - A Review

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ABSTRACT

The conventional system of medicine requires the bioactive constituents from the extracts of different plants. From time immemorial India is mostly rely on conventional medicine. In fact the modern medicine was evolved from the base herbal medicine. *Echinops echinatus* Roxb, (Ee) belonging to family Asteraceae and commonly known as Bramhadandi, is widely used in traditional system of medicines for treatment of ophthalmic, chronic fever, pains in the joints, inflammations and used in brain disorders. The plant is bitter, pungent, stomachic, analgesic, antipyretic, increases the appetite and stimulates the liver. The root is abortifacient and aphrodisiac. Pharmacological activities of the plant reported are antioxidant, anti-inflammatory, antifungal, analgesic, anthelmintic, anti-fertility, hypoglycaemic, hepatoprotective and diuretic, effect. The present review highlighted the various traditional uses as well as phytochemical and pharmacological activities outlined from *Echinops echinatus* Roxb.

Keywords: *Echinops echinatus* Roxb, phytochemical activity, pharmacological activity, traditional uses.

INTRODUCTION

Bramhadandi common name of *Echinops echinatus* Roxb is a pubescent annual herb of 1-3ft height with branches generally spreading from the base. The species are found practically throughout India and useful for the treatment of various ailments in the Indian system of medicine¹. This literature search acknowledges that the plant is a popular remedy for a variety of ailments and very little effort have been made to check its efficacy through scientific screenings in animal model. The present review focused on various folk, Ayurvedic uses, pharmacognostical, phytochemical and pharmacological studies conducted on *Echinops echinatus* Roxb, and also highlight unexplored potential of it.

Geographical Distribution

It is distributed all over India, Afghanistan and Pakistan ascending to 5000 ft on the hills¹.

Parts of the plants used

Whole plants, Leaves, Roots and Seeds.

Vernacular names²

English: Indian Globe Thistle

Hindi: Gokhru, Uthkanta, Utakatira

Gujarati : Shuliyo, Utkanto, Utkato

Sanskrit: Kantalu, Kantaphala, Utati, Utkantaka

Sindhi : Dammai

Urdu :Barham dandi, Labh, Unt katara

Telugu: Brahmadandi

Kannada : Brahmadande

Marathi: Utkatar, Kate-chendu

Taxonomic Classification³

Kingdom : Plantae

Phylum : Magnoliophyta

Class : Magnoliopsida

Subclass : Asteridae

Order : Asterales

Family : Asteraceae

Genus : *Echinops*

Species : *echinatus*

Flowering

October, December-January⁴

Pharmacognostical Description⁵

Herb

A hard, pubescent, annual up to 1-3 ft height, with branches extensively spreading from the base.

Leaves

Alternate, oblong, sessile, pinnatifid, covered with cottony wool beneath, the lobes triangular and oblong, simulate and spiny, the spines often 2.5cm long. Deeply pinnatifid leaves are 7-12 cm long.

Flower

Heads are white or purple, compact, globose, clustered at the ends of branches; involucre surrounded by strong white bristles resembling pappus-hairs; pappus short, yellowish, forming a short cylindrical brush above the achene, heads occur in solitary white spherical balls 3-5cm across, petals of the tiny white flowers are 5mm long.

Phytochemistry

Aerial parts of the plant contain alkaloids, **echinopsine**, **echinopsidine** and **echinozolinone**.

Taraxasterol acetate, **Apigenin** and its derivatives, **echinacin** and **echinaticin**. 2',5,7 trihydroxy-3,6-dimethoxyflavone-7-O-b-D-galactopyranosyl-[1@4]-O-a-Lrhamnopyranoside is reported from the seeds of *Echinops echinatus*Roxb.[5]



Aerial parts of EeFlowers of EeLeaves of EeWhole plant with roots

An antiinflammatory active flavanone glycoside 5,7-dihydroxy-8,4'-dimethoxyflavanone-5-O- α -L-rhamnopyranosyl-7-O- β -D-arabinopyranosyl-(1 \rightarrow 4)-O- β -D-glucopyranoside A along with a known compd. dihydroquercetin-4'-Me ether is also reported from the leaves of *Echinops echinatus* Roxb⁶.

Analysis of the *Echinops echinatus* Roxb, flowers gave: *n*-hentriacontane, *n*-hentriacontanol, lupeol, lupeol acetate, β -amyrin, β -amyrin acetate, β -sitosterol, palmitic acid, betulinic acid, apigenin, luteolin, quercetin, apigenin-7-*o*-glucoside, luteolin-7-*o*-glucoside, apigenin-7-*o*- β -D-(4''-*p*-coumaroyl)-glucoside, echinopsine and a minor alkaloid 7-hydroxy echinozolinone⁷.

A new isoflavone glycoside, echinoside, together with 7-hydroxyisoflavone, kaempferol-4'-methylether, kaempferol-7-methylether, myrecetin-3-*o*- α -L-rhamnaoside, kaempferol and kaempferol-3-*o*- α -L-rhamnoside, has been isolated from the whole plant of *Echinops echinatus* Roxb⁸.

In addition to echinopsine and echinopsidine, a new alkaloid, echinozolinone, has been identified in *Echinops echinatus* Roxb, as 3(2-hydroxyethyl)-4(3H)-quinazolinone. from its spectral data⁹.

Various carbohydrates and amino acids were obtained by chemical examination of the seeds of *Echinops echinatus* Roxb, plant¹⁰.

70% Hydroethanolic extracts of *Echinops echinatus* roots were studied to establish HPTLC fingerprint profile. Toluene: Ethyl Acetate: Methanol (7:2:1) v/v was the solvent system and precoated aluminium plate of silica gel 60 F₂₅₄ (10X10 cm) with 0.2mm thickness was the stationary phase. The bands on the HPTLC were separated and scanned under UV at 254nm, 366nm and visible 580nm. 70% Hydroethanolic extracts of *Echinops echinatus* roots exhibited the presence of possible no of components¹¹.

Therapeutic uses

Root

An ethnomedicinal survey was carried out by Kakrani et al,¹² the rural population of Kutch region in Gujarat, India, use the root bark powder suspension in milk (100g/250ml) to treat the Diabetes. Traditionally the healers of chhattisgarh in India was used this herb in different ways both externally and internally to treat the sexual disorders. Aqueous paste of the root bark powder was applied externally on the male genitals one hour before inter course for the patients having poor sexual vitality¹³. The root is abortifacient aphrodisiac¹⁴. Root bark powder was also used in treatment of hoarse cough and fever in children¹⁵.

The root powder of the plant was applied to wounds on cattle to destroy maggots and mixed with acacia gum for the application on hair¹⁶.

Whole plant

Echinops echinatus Roxb, is stomachic, bitter, antipyretic, analgesic, increases the appetite stimulates the liver, useful in brain disease, Cough suppressant, and also used in ophthalmia, chronic fever, inflammations, pains in the joints and Urinary disorder.¹⁷ the whole plant was advised as antipyretic and analgesic¹⁸ and to treat inflammations joint pains and diuretic activity¹⁵. Though the plant has been reported for many biological activities like anti-inflammatory¹⁷, hypoglycemic and diuretic¹⁹, antibacterial and antifungal²⁰, antispasmodic²¹ etc.

Leaves

The fumes obtained by burning of leaves and roots of *Echinops echinatus* were used in the treatment of asthma and respiratory disorders to get quick and permanent relief²².

Seeds

The seeds are sweet and aphrodisiac¹⁴.

Pharmacological properties

Anti-inflammatory

Anti-inflammatory activity was studied on ethanolic extract of *Echinops echinatus* Roxb. whole plant. The extract effectively inhibited the acute inflammation induced in rats by carrageenan, formaldehyde and adjuvant and the chronic arthritis induced by formaldehyde and adjuvant. The parenteral dose of extract showed more effectiveness than oral dose. The toxicity studies showed reasonable safety²³.

Antifungal activity

Four phenolic compounds, viz., apigenin, apigenin-7-*O*-glucoside, echinacin, and echinaticin, were isolated from the whole plant of *Echinops echinatus* Roxb. The compounds were assayed against germination of conidia of *Alternaria tenuissima*, which incites leaf blight disease in pigeon pea. All showed high efficacy against the pathogen at concentrations ranging from 25 to 150⁻¹ mL μ g. Echinacin, which was highly effective at 150⁻¹ and considered the most effective among the compounds and its use as a control measure against *Alternaria* blight of pigeon pea under field conditions has been proposed²⁴.

Hepatoprotective activity

From the aerial parts of the *Echinops echinatus* Roxb, ethanolic extract was prepared and evaluated for its hepatoprotective activity. At the dose of 500 and 750 mg/kg/day, p.o., for 7 days against CCl₄ (0.75 ml/kg, s/c.) intoxicated rabbits were evaluated by serum biochemical

Sugars	Amino acids
L-Rhamnose	Aspartic acid
D-Galactose	Valine
D-Fructose	Leucine
D-Glucose	Glutamic acid
D-Arabinose	Glycine
D-Xylose	
D-Ribose	

parameters and liver histopathological observations. Silymarin at the dose of 100 mg/kg/day, p.o., for 7 days was used as a standard hepatoprotective drug. CCl₄ intoxicated group had raised levels of SGOT, SGPT and ALP significantly but TB level was not raised as compared to normal control group. Histopathological studies of the liver tissue showed that the plant having hepatoprotective activity²⁵.

Antidiabetic activity

The methanolic extract of roots bark (250 and 350 mg/kg) and aerial parts (250 and 350 mg/kg) of *Echinops echinatus* Roxb, were studied for antidiabetic activity using alloxan induced hyperglycemia. The action of extract on diabetes induces hyperlipidemia was analysed where the extracts significantly lowered the elevated cholesterol as well as LDL level. The anti hyperglycemic action of the extracts showed through blocking of glucose absorption. All extract of *Echinops echinatus* Roxb, produced a significant anti-diabetic activity²⁶.

70% Hydroalcoholic *Echinops echinatus* root extract was evaluated at the dose of 100&200mg/kg body weight p.o. in Diabetic Nephropathic rats for anti-diabetic activity. *Echinops echinatus* showed 72% α - amylase inhibitory effect against Diastase at the concentration of 25 mg/ml. Histopathological studies of group IV and group V showed significant regeneration of cells in Diabetic nephropathic rats. The dose 200mg/ kg body weight produced more effect than 100mg/kg body weight as nephroprotective and significantly restored oral glucose tolerance test, blood glucose levels, Serum creatinine and serum lipid profile. It was suggested that the the root extract of *Echinops echinatus* possesses anti diabetic activity which may be due to the presence of flavonoids in the extract²⁷.

Antioxidant activity

The antioxidant activity of extracts of *Echinops echinatus* Roxb., were evaluated for radical scavenging activities using different in vitro models like scavenging of 2,2 diphenyl-1-picrylhydrazyl (DPPH) radical, superoxide anion radical and nitric oxide radical. The ethanolic extract of *Echinops echinatus* Roxb, root showed potent free radical activity when compared to standard ascorbic acid. The observed activity may be due to the presence of flavonoid and higher phenolic content in the extract²⁸.

Analgesic activity

The methanolic extracts of aerial parts and roots of *Echinops echinatus* was studied for analgesic activity in albino rats using Hot plate, Tail flick and Tail immersion models. Pentazocine was used as standard and the reaction time was the parameter. Methanolic extracts at 250 mg/kg and 500 mg/kg body weight showed a significant increase in reaction time when compared to control. It was

concluded that the constituents present in both methanolic extracts showed significant Analgesic activity²⁹.

Diuretic activity

The methanolic extracts of aerial parts and roots were assessed for diuretic activity in albino rats using in-vivo Lipschitz test model. Frusemide was the standard and volumes of urine, urinary concentration of sodium and potassium ions were the parameters of the study. The methanolic extracts at 250 mg/kg and 500 mg/kg body weight showed a significant increase in the urine volume and electrolyte excretion when compared to control. Both the extracts showed significant diuretic activity. It was concluded that the constituents present in methanolic extracts may be responsible for diuretic activity³⁰.

Protective effect

Echinops echinatus Roxb, extracts reduced the increase in the prostatic/body weight ratio induced by testosterone. But anolic fraction of ethanolic extract exhibited the best activity. Testosterone levels measured weekly and prostate-specific antigen (PSA) levels. The histological studies showed a considerable improvement in the prostatic histoarchitecture in the extract-treated groups when compared with testosterone treated group. *Echinops echinatus* Roxb, proved to be a promising agent for its anti-androgenic action and in the treatment of BPH³¹.

Antifertility activity

Echinops echinatus Roxb was administered orally to male albino rats at dose level of 50, 100 and 200 mg/kg body weight/day/rat orally for 60 days, significantly decreased the weight of testes, epidyides, ventralprostate, vas deferens and seminal vehicle. Sperm motility and sperm density also showed significant reduction. The concentration of protein, ascorbic acid, sialic acid, fructose, acid/alkaline phosphatase were significantly decreased in *Echinops echinatus* Roxb, treated groups. *Echinops echinatus* Roxb, inhibits spermatogenesis in many animals. It was observed that antifertility effect may be a combination of the effect on the developing spermatids as well as that on spermatozoa motility³².

Reproductive parameters of male rats

The terpenoidal fraction prepared from the petroleum ether extract of the roots of *Echinops echinatus* Roxb, was evaluated on male reproductive parameters. The studies were carried out at two different dose levels of 30 and 60 mg/kg body weight using Wistar albino rats. Treatment with terpenoidal fraction showed a decrease in the relative weight of the reproductive organs without affecting the final body weight of the animals, and a significant decrease in serum testosterone levels and cauda epididymal sperm concentration compared with animals in the control group³³.

Antiasthmatic activity

Ethanolic extract of roots of *Echinops echinatus* Roxb was evaluated for antiasthmatic activity using animal model. Evaluation was done for ethanolic extract of roots of Ee and tracheal chain Histamine induced contraction was observed in isolated goat and inhibited the contractile effect of histamine P<0.05. A dose dependent contraction of goat tracheal chain was observed during the evaluation. In addition the root contain Lupeol which can cause

reduction of eosinophils, which may also contribute the antiasthmatic action of the plant³⁴.

Antitussive activity

Herbal cough syrup was formulated from aqueous extract of *Echinops echinatus* roots Mulethi extract (*Glycyrrhiza glabra* Linn.), Lindi pepper extract (*Piper longum*), Haldi (*Curcuma longa* Linn.), Menthol (*Menthapiperita*), Clove oil (*Eugenia caryophyllus*), Ajwan oil (*Trachyspermum ammi*), Ginger oil (*Zingiber officinale*) and evaluated for antitussive effect. Evaluation parameters like Viscosity, density, P^H, Gravity, Specific gravity, Microbial contamination were checked for the formulation. Accelerated stability study was done in a span of three months and changes were not observed. It suggested that it may be used as stable liquid dosage form³⁵.

CONCLUSION

Echinops echinatus Roxb, has been in use since ancient times to treat widerange of diseases in traditional system medicine. The present review provides information regarding scientific and conventional use of the plant. It is an attempt to unite the relevant available information of the species and proven its antidiabetic, antihypertensive, analgesic, antiinflammatory, antifungal activity, hepatoprotective, antifertility, antioxidant, diuretic and protective effects. From the above information it is concluded that it is a unique natural product for the development of medicines against various diseases and also for the development of industrial products.

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