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## **Pharmacognostical, phytochemical and pharmacological of *Echinops Echinatus* Roxb: A comprehensive review**

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### **ABSTRACT**

In traditional medicine most of the diseases have been treated by administration of plant or plant product. *Echinops echinatus* Roxb is the useful traditional medicinal plant in India. During the last five decades, apart from the chemistry of the *Echinops echinatus* Roxb compounds, considerable progress has been achieved regarding the biological activity and medicinal applications of *Echinops echinatus* Roxb. Various parts of the plant like seeds, roots, leaves, flowers, bark and fruits have been investigated for their significant phytochemicals. Phytochemicals like flavanol glycoside Kaempferol, kaempferol 4'-methylether, kaempferol 7-methylether, kaempferol 3-O- alpha- L- rhamnoside, myrecetin-3-O-alpha-L-rhamnoside have been reported for significant, anti-inflammatory, hypoglycemic and diuretic, antibacterial and antifungal, antispasmodic etc. The article reviews is an attempt to compile and documented information on different aspect of *Echinops echinatus* Roxb pharmacological properties and highlight the need for research and their potential development.

**Keywords:** Traditional medicine, *Echinops echinatus* Roxb, pharmacological action, biological activity.

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### **INTRODUCTION**

Herbal medicine plays an important role in the healthcare of many developing countries. The use of herbal products is increasing worldwide due to the distinct advantages. Herbal medicines include herbs, herbal materials, herbal preparations and finished herbal products that contain as active ingredients parts of plants, or other plant materials, or combinations. The protection of knowledge, innovations and practices of traditional and indigenous medicine has been in the forefront of international developments. Isolation, purification and structure elucidation of a new chemical entity from a medicinal plant; discovery and characterization of novel, unobvious and useful biological properties, synthesis of useful new analogues or derivatives, formulation for a combination of herbal medicine in new dosage form with higher therapeutic efficacy are patent eligible subject matter. Further, new indications, extraction and separation of active ingredients from herbal drugs used in the production of pharmaceutical substances, preparation and

processing techniques of standardized extracts are also patentable.<sup>1-2</sup>

History of medicine goes back practically to the existence of human being. The current accepted Modern Medicine or allopathy has gradually developed over the years of scientific and observational efforts of scientists-however, the basis of its development remains in the roots of traditional medicine and therapies. Plants are the most exclusive source of drugs for the majority of World's population. Global estimate indicates that 80% of about four billion populations are using traditional medicines, which are mainly derived from medicinal plants listing over 20,000 species. Even in the allopathic medicine 25% of the prescription, substances are derived from higher plants. India is perhaps the largest producer of medicinal herbs and is rightly called the "Botanical Garden of the World". Except very few, all medicinal herbs of commercial importance are collected or cultivated in this country. Medicinal herbs have been of use for thousands of years in one form or another under the indigenous systems of medicine like Ayurveda, Siddha and Unani.

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Since independence in 1947, India has made tremendous progress in Agro technology, process-technology, standardization, quality control, and research and development etc. The WHO also appreciated the importance of medicinal plants for public health care in developing nations and evolved guidelines to support the member states in their efforts to formulate national policies on traditional medicine and to study their potential usefulness including evaluation, safety and efficacy.<sup>3</sup>

**Advantages of Herbal Medicine:** - 4-5

**Cost:** Herbal medicine products are far cheaper than many pharmaceutical alternatives. They do not need to undergo long and expensive clinical testing and are subject to healthy market forces due to this lack of regulation as well. All this adds up to more money in your pocket in addition to increased health.

**Availability:** Because the FDA tightly regulates the pharmaceutical industry, there are simply far more herbal medicine products available for consumption. These products are also available without prescription, cutting out another factor in the heavy cost of pharmaceutical drugs: the doctor. You can also grow the herbs that you need and that will help you on the road towards wellness.

**Safety:** Herbal medicines tend to derive themselves from relatively harmless plant matter that the human body can easily digest. Prescription drugs, on the other hand, are composed of a great variety of products that supplement the lead compound. The clinical trials that those drugs undergo are never a guarantee of entire harmlessness, and many adverse side effects are simply documented rather than used as grounds for dismissal. For instance, the worst side effect most herbal medicines have are issues such as diarrhoea or constipation due to

their effect on the digestive system, while pharmaceutical drugs can cause cardiovascular problems and even induce obesity. Also, most herbal medicines have a plethora of product reviews, allowing the good to be weeded out from the bad by consumers themselves.

**Natural:** - Herbal medicines are natural products of the world and combine with your body's own immune system to create an even detoxification process. Principles of eastern medicine include ideas such as the importance of harmony between mind and body, and an excellent way to produce such a state is to stay within the limits of nature. Though the lead compound of pharmaceutical drugs tend to be natural, they are often times mixed with synthetic and artificial variables which can cause adverse side effects.

**Disadvantages of Herbal Medicines:** - 4-5

**Lack of Regulation:** - Though herbal medicines contain an inherent positive due to their lack of regulation, they can, at the same time, occasionally cause issues. For instance, the lack of governmental oversight means that an herbal medicine company's product has not been tested on a wide range of consumers, and so their effects may be unpredictable.

**Patience Needed:** - Herbal medicines require consistent use over a longer period of time than most prescription drugs. They have not been optimized in a laboratory for effectiveness, and, due to this naturalness, it takes time to implement effectively.

**Adverse Interaction with Prescription Drugs:** - If you are taking prescription drugs on a regular basis, such as antidepressants, herbal medicines can mix with these chemicals to create adverse effects to you.<sup>5</sup>

**PHARMACOGNOSTIC STUDY OF ECHINOPS ECHINATUS:** 6-9



Figure 1. *Echinops echinatus* (Roxb.)

**Taxonomic Classification**

Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Order	Asterales
Family	Asteraceae
Genus	<i>Echinops</i>
Species	<i>Echinatus</i>

**Family:** Asteraceae

**Part used:** Whole plants, Roots, Seeds and Leaves

**Vernacular names:**

**English:** Indian Globe Thistle

**Gujarati:** Shuliyo, Utkanto, Utkato

**Hindi:** Gokhru, Uthkanta, Utakatira

**Sanskrit:** Kantalu, Kantaphala, Utati, Utkantaka, Utkatotkata, Vritttaguchha

**Distribution:** More or less throughout India and Afghanistan.

**Leaves:** Alternately arranged oblong, deeply pinnatifid leaves are 7-12 cm long.

**Flowers:** Flower-heads occur in solitary white spherical balls, 3-5 cm across. Petals of the tiny white flowers are 5 mm long. Flowers are surrounded by straight, strong and white. Odour is pungent and taste is bitter.

**Description:** *Echinops echinatus* Roxb, (Asteraceae) is a pubescent annual herb of 1-3ft height with branches widely spreading from the base. Is a perennial, 40-100cm high, Stems are simple or branching from the base, sparsely cobweb by-canescens. Leaves are lanceolate or oblong-lanceolate. It has short, stout stems, branching from the base, covered with white cottony hair. The species is found practically throughout India, Pakistan, Afghanistan, etc

**Uses:** The plant is pungent, bitter and hot, improves the taste and cures kapha and vata. It is used in urinary disorder, liver disorder, heart diseases, etc. The root is abortifacient aphrodisiac. The seeds are sweet and aphrodisiac (Aurveda). The plant is bitter, stomachic, antipyretic, analgesic, increases the appetite stimulates the liver, useful in brain disease, used in ophthalmia, chronic fever, pains in the joints, inflammations, the root is aphrodisiac (yunani). The drug is bitter and is consider being tonic and diuretic. The roots are pounded and mixed with acacia gum and applied to the hair to destroy lice. The powder roots are also applied to wounds in cattles to destroy maggots (Hughes-Buller). The Plant is bitter, increases the appetite and stimulates liver; used in diseases of the brain, pains in the joints, inflammations, etc. Roots and root bark of the plant are used in various indigenous systems of medicine

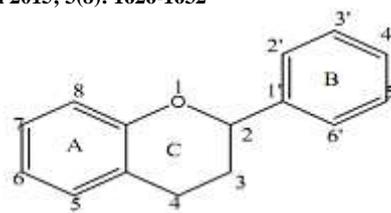
for treating different ailments. The root is used as abortifacient and aphrodisiac, infusion of the root is given in seminal debility, impotence, hysteria, and its decoction is given in dyspepsia, scrofula, syphilis and fevers.

The rural population of Kutch region in Gujarat state, India, uses the suspension of root bark powder in milk (100g/250ml) for the treatment of diabetes. The traditional healers of Chhattisgarh in India use this herb in different ways both internally and externally for the treatment of sexual disorders. An aqueous paste of the root is applied in the lower abdominal region to hasten the process of delivery; also the patients are advised to take the paste internally for quick and safe delivery. In case of patients having poor sexual vitality, aqueous paste of the root bark powder is applied externally on the male genitals one hour before intercourse; pure honey can be used in place of water for better results. A paste prepared by mixing the root bark powder with the juice of *Datura stramonium* and *Blumea lacera* leaves is used to avoid premature ejaculation. The patients suffering from respiratory troubles, particularly asthma, are advised to inhale the fumes obtained by burning the leaves & roots of *E. echinatus* in order to get quick and permanent relief. Though the plant has been reported for many biological activities like anti-inflammatory, hypoglycemic and diuretic, antibacterial and antifungal, antispasmodic etc.

#### PHYTOCHEMICALS PRESENT IN THE ECHINOPS ECHINATUS: -<sup>10-21</sup>

*Echinops* plant was reported to possess variety of compounds belonging to various classes like: alkaloids, flavonoids, terpenoids, lipids, steroids and polyacetylenes. Many literature survey revealed different pharmacological activities of *Echinops* plant like, antibacterial activity, antifungal, antioxidant activity, protective effects on testosterone-induced prostatic hyperplasia, hepatoprotective and anti-ulcerogenic activity. Flavonoids (Figure 2) are a class of natural products that gains interest due to the different pharmacological activities since Flavonoids are powerful antioxidants against free radicals and

are described as free-radical scavengers. This activity is attributed to their hydrogen-donating ability. Indeed, the phenolic groups of flavonoids serve as a source of a readily available "H" atoms such that the subsequent radicals produced can be delocalized over the flavonoids structure. Also flavonoids have anti-inflammatory action, anti-bacterial, anti-fungal effect. Flavonoids protect the gastrointestinal mucosa from lesions produced by various experimental ulcer models and against different necrotic agents, also they possess anti-carcinogenic effects since they can interfere with the initiation, development and progression of cancer by the modulation of cellular proliferation, differentiation, apoptosis, angiogenesis and metastasis.<sup>12-17</sup>



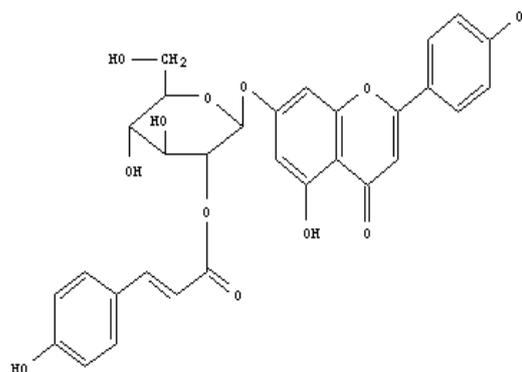
**Figure 2. Basic structure of flavonoids**

The most important flavonoids glycoside isolated from different species of Echinops plant are listed in the following table (Table 1). This study was emphasized on the isolation and identification of flavonoids glycoside found in the Iraqi species of Echinops plant by column Chromatography (CC), using glass column packed with polyamide 6 slurry in ethanol.

**Table 1. Flavonoids glycoside isolated from different species of Echinops plant**

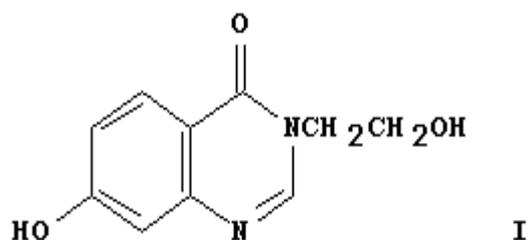
Flavonoids	Sources
Kaempferol, kaempferol 4'-methylether, kaempferol 7-methylether, kaempferol 3-O- alpha- L- rhamnoside, myrecetin-3-O-alpha-L-rhamnoside	Echinops echinatus
Dihydroquercetin-4'-methyl ether, 5,7 -8,4 -dimethoxyflavanone-5-O- -L-rhamnopyranosyl- 7-O- -D-arabinopyranosyl-(1 4)-O- -D-glucopyranoside	Echinops echinatus
Silymarine	Echinops tenuisectus
Quercetin	Echinops tenuisectus
Apigenin (4',5,7-trihydroxyflavone, luteolin)	Echinops niveus
Kaempferol	Echinops galalensis and Echinops hussoni
Apigenin, hispidulin, 5,4dihydroxy flavone and apigenin 7-O- glucoside	Echinops spinosissimus
Apigenin	Echinops latifolius
Kaempferol, myricetin	Echinops spinosus
Neoflavonoid nivetin	Echinops niveus
Apigenin, apigenin-7-O-glucoside, echinacin, and echinaticin	Echinops echinatus

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 from the seeds of Echinops echinatus.<sup>18-19</sup> Apigenin, apigenin 7-O-glucoside, and a new acylflavoneglucoside named echitin (I) were isolated from *Echinopsechinatus* flowers.

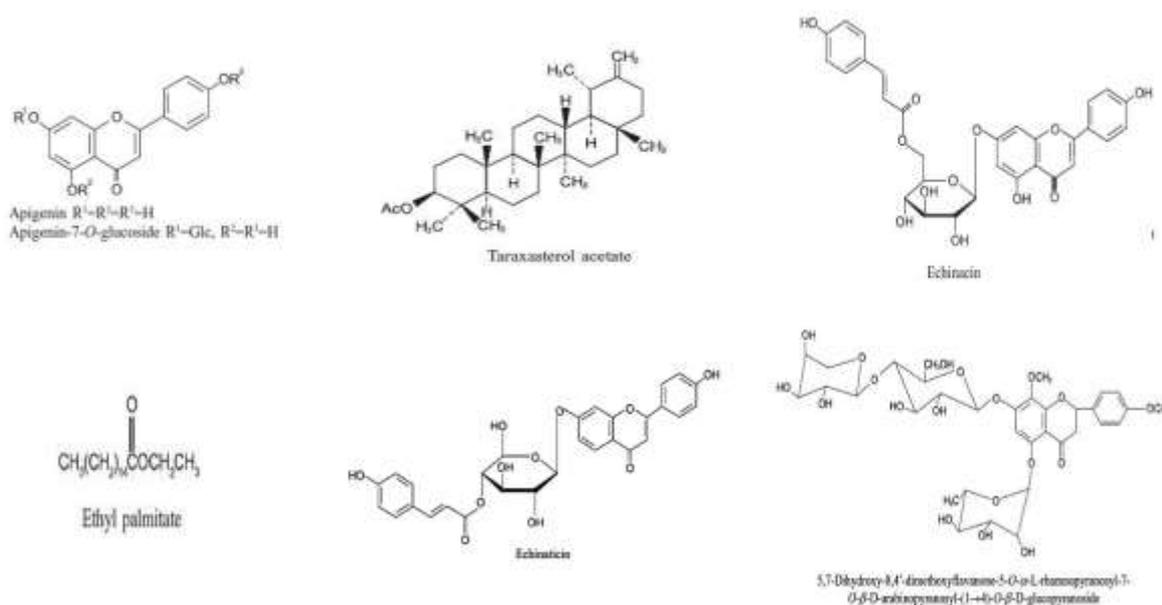


I

A minor alkaloid 7-hydroxyechinozolinone (I) is reported from the flowers of *E. echinatus*



An antiinflammatory active flavanone glycoside 5,7-dihydroxy-8,4'-dimethoxyflavanone-5-O- $\alpha$ -L-rhamnopyranosyl-7-O- $\beta$ -D-arabinopyranosyl-(1 $\rightarrow$ 4)-O- $\beta$ -D-glucopyranoside A along with a known compd. dihydroquercetin-4'-Me ether is also reported from the leaves of *Echinops echinatus*. A minor alkaloid 7-hydroxy echinozolinone (I) is reported from the flowers of *E. echinatus*. Four phenolic compounds. apigenin, apigenin 7-O-glucoside, echinacin(I), and echinaticin (II), were are reported from *E. echinatus* Roxb.



**Fig. 3: Major Bioactive Phytoconstituents of Echinops Species.**

Isomeric acyl flavone glycosides echinacin (I) and echinaticin (II) are reported from *E. echinatus*. Chaudhuri PK26 (1997) isolated Echinozolinone an alkaloid from *Echinops echinatus*. In addition to echinopsine and echinopsidine, a new alkaloid, echinozolinone, has been identified in *Echinops echinatus* as 3(2-hydroxyethyl)-4(3H)-quinazolinone from its spectral data. Besides apigenin 7-O-glucoside, a new acylated one has been identified in *Echinops echinatus* as apigenin 7-O-(4'-cis-pcouyl- $\alpha$ -e from spectral and chemical analysis.<sup>20-21</sup>

### PHARMACOLOGICAL ACTIVITIES AND MEDICINAL USE OF ECHINOPS ECHINATUS:<sup>21-30</sup>

**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 latter two compounds were isolated for the first time. The two derivatives echinacinpermethyl ether and apigenin-5, 4'-dimethyl ether were obtained by methylation

of echinacin and apigenin-7-O-glucoside permethylate, respectively. All the compounds were assayed against germination of conidia of *Alternariatenuissima* (Kunz. ex Pers.) Wiltshire, which incites leaf blight disease in pigeon pea (*Cajanuscajan.*). All showed high efficacy against the pathogen at concentrations ranging from 25 to 150<sup>-1</sup>mL  $\mu$ g Echinacin, which was highly effective at 150<sup>-1</sup>, is considered the most promising of these compounds and its use as a control measure against *Alternaria* blight of pigeon pea under field conditions has been suggested.

**Anti-inflammatory:** Anti-inflammatory studies were conducted on an ethanol extract of *Echinops echinatus* whole plant. The extract effectively inhibited the acute inflammation induced in rats by carrageenan, formaldehyde, adjuvant and the chronic arthritis induced by formaldehyde and adjuvant. The extract was more effective parenterally than orally. The toxicity studies showed reasonable safety warranting further studies.

**Analgesic:** The Analgesic potential of methanolic extracts of the aerial parts and roots was assessed in albino rats using Hot plate, Tail immersion and Tail flick models. The reaction time was the parameter of the study. Pentazocine was used as standard. The results indicate that methanolic extracts at 250 mg/kg and 500 mg/kg body weight shows a significant increase in reaction time when compared to control. Both the extracts show significant Analgesic activity. From the present study it may be concluded that the constituents present in methanolic extracts may be responsible for Analgesic activity.

**Diuretic:** The diuretic potential of methanolic extracts of the aerial parts and roots was assessed in albino rats using in-vivo Lipschitz test model. The volumes of urine, urinary concentration of sodium and potassium ions were the parameters of the study. Frusemide was used as standard. The results indicate that methanolic extracts at 250 mg/kg and 500 mg/kg bodyweight shows a significant increase in the urine volume and electrolyte excretion when compared to control. Both the extracts show significant diuretic activity. From the present study it may be concluded that the constituents present in methanolic extracts may be responsible for diuretic activity.

**Protective effect:** *E. echinatus* extracts attenuated the increase in the prostatic/body weight ratio induced by testosterone. Butanolic fraction of ethanolic extract exhibited the best activity. Testosterone levels measured weekly and prostate-specific antigen (PSA) levels. Further histological studies have shown a considerable improvement in

the prostatic histoarchitecture in the extract-treated groups when compared with testosterone treated group. Studies suggest that the use of *E. echinatus* as Brahmadandi is not justifiable in light of its antiandrogenic action. *E. echinatus* proved to be a promising agent for the treatment of BPH.

**Reproductive parameters of male rats:** Study was undertaken to evaluate the effect of terpenoidal fraction prepared from the petroleum ether extract of the roots of *Echinops echinatus* 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 ( $P < 0.01$ ) in serum testosterone levels and caudaepididymal sperm concentration compared with animals in the control group.

## CONCLUSION

The above work cited in the article of phytochemicals and promising pharmacological activities are widely distributed in medicinal plant of *Echinops echinatus* and it revealed the importance of herbal and ayurvedic pathway for effective treatment of various diseases considering its tremendous potential pharmacological activities. Animal studies enlighten anti-inflammatory, hypoglycemic and diuretic, antibacterial and antifungal, antispasmodic etc. activities of phytochemicals.

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