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A REVIEW ON PHYTOCONSTITUENTS AND PHARMACOLOGICAL ASPECTS OF ELAEOCARPUS GANITRUS (RUDRAKSHA) PLANT

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ABSTRACT

Medicinal plants which are considered a good source of life due to its rich medicinal properties. Most people use medicinal plants to treat various ailments and have a significant impact on the world's economy and are considered to be the "backbone" of traditional medicine. One such medicinal plant is *Elaeocarpus ganitrus* also known as the Rudraksha, family Elaeocarpaceae, found in tropical and subtropical climates. Different parts of *E.ganitrus* have shown the presence of alkaloids, flavonoids, tannins, steroids, triterpenoids, cardiac glycosides and these have anti-hypertensive activity, antioxidant, antidepressant, analgesic, antidiabetic, antiasthmatic, antihyperlipidemic and cytotoxic activity. The review article is designed to study the phytochemical investigation of various extracts and its pharmacological properties.

KEYWORDS: *Elaeocarpus ganitrus*, Rudraksha, Quercetin, Anti-atherosclerotic Nephroprotective activity, *E.floribundus* etc.

INTRODUCTION

In India species of *Elaeocarpus* locally named as Rudraksha, belongs to *Elaeocarpacea*e family.

It contain beads or nuts which are strong and highly decorative stony endocarp.[1]

Elaeocarpus ganitrus occupies an important place in Hinduism and Ayurveda. For the purpose of reciting prayers the fruits of the plant are worn by Hindu mysteries as necklaces. It

can be considered as King for effective and efficient herbal medicine. It has many spiritual and therapeutic principles for protection and healing.[2]

The medicinal and biological functions of Plant depend on constituents (alkaloids, tannins, flavonoids, steroids, glycoside and phenols) that are used to treat various ailments such as mental disorders, headache, skin disease and fever. It has been recounted to reveal pharmacological effect like antihypertensive, antioxidant, hypoglycemic, anti-inflammatory, anti-atherosclerotic and other.

Taxonomical classification

Kingdom- Plantae

Division- Magnoliophyta

Class- Magnoliopsida

Order- Oxalidales

Family- Elaeocarpaceae

Genus- Elaeocarpus

Species- *ganitrus*

Plant description

It is a huge evergreen tree with height 50-200 feet. The leaves are large and simple having oblong lanceolate. Flowers (yellow or white in colour) appear in the month of April and May. Seed is hard (round, bulbous shape) blue in color and sour in taste. The inner part of seed (bead) is called Rudraksha. Fruits (round or oval in shape) visible in June and ripen near October. The colour of fruits is blue or violet and taste is acidic. The endocarp is hard, globular and reddish brown in color.[3-4]

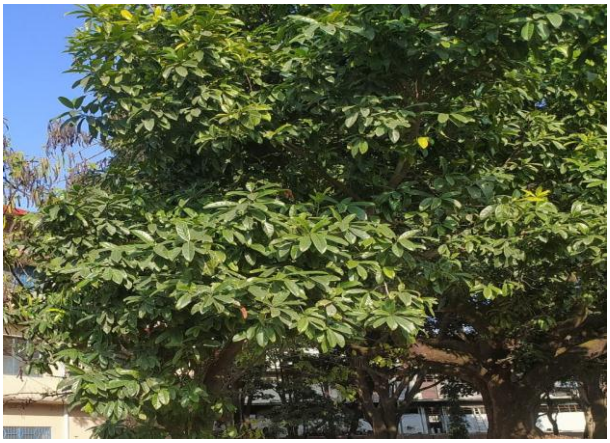

Figure no. 01: *Elaeocarpus ganitrus.*

Chemical constituents

Phytoconstituent such as glycosides, steroids, alkaloids and flavonoids are found in *E.ganitrus* fruit. Apart from this, fruit extract also provide nutritious rewards to consumers, especially those that are rich in carbohydrates (21.0% dry weight, or 0.58 g per fruit) and protein (4.3% dry weight, or 0.12g per fruit).[5] Quercetin, gallic and ellagic acid are present in the leaves of *E.ganitrus*. Singh says that a significant amount of phytocomponents such as isoelaeocarpicine, elaeocapine, isoelaeocarpine and rudrakine. Three new ellagic acid derivatives of eleocarpaceae, 4-Omethylellagic acid 3-0-a-rhamnoside, 4-Omethylellagic acid 30-(300-O-acetyl)-a-rhamnoside and 4-Omethylellagic acid 30-(400-Oacetyl)- a-rhamnoside in addition to the known ellagic acid derivative, 4-O-methylellagic acid 30- (200,300-di-Oacetyl)-a-rhamnoside are used in multi besieged therapy of cancer and a significant antioxidant ability due to its wealthy content of tannins and flavonoids.[6-7]

Phytoconstituents extracted from different parts of plant

Fruit extract

Phytochemical quality assurance of *E.ganitrus* fruit extract reveals the presence of alkaloids, flavonoids, steroids, glycosides, terpenoids, saponins, carbohydrates and fats. Proteins and amino acids were not present in the extracted fruit.

Total amount of phenolic and flavonoids present in *E.ganitrus* fruit are:
232.24 ± 0.31 and 91.42 ± 0.44(mg/gm).[8]

Beads extract

The anxiolytic component of quercetin derivative was separated from ethanol extract of beads of *E.ganitrus* and also used as a marker to resemble the plant.[9] In the form of glycoside quercetin occurs in *E.ganitrus* beads.

Leaves extract

The Ethanolic leaves extract of *E.ganitrus* produces quercetin, gallic and ellagic acid, (±) elaeocarpine, (±) isoeocarpine and rudrakine.[7] A study by Kumar et al., (2008) revealed the presence of phenolic and flavonoids in leaves of *E.ganitrus* provides great antioxidant activity. Singh et al., also reported on the odorless alkaloid indolizidine as rudrakine isolated from leaves of *E.ganitrus*.[10]

Seed extract

Bharti et al. (2013) reported that Kaempferol and Quercetin were found to dominant in *E.ganitrus* seeds. The extracellular content of C-glycosides of apigenin and quercetin in all seed samples was significantly higher than flavonol compounds. In contrast, sample release of C-glycosides of apigenin and luteolin was prominent.[11]

Tewari et al. (2015) studied that phytochemical analysis of petroleum ether, acetone and methanol extracted from E.ganitrus seed for the presence and / or absence of various phytoconstituent such as alkaloids, carbohydrates, glycosides, sterols, phenolics, flavonoids and saponins and revealed the presence of a very high amount of phytoconstituents on methanol extracts. Both complete and sequential methanol extracts clearly show the presence of alkaloids, carbohydrates, sterols and flavonoids.[12]

Pharmacological studies

Antidepressant activity: The 90 % ethanolic extract of the fruits of *E. ganitrus* has been shown to have a significant effect on the central nervous system depression, characterized by common behaviors, morphine analgesia, anticonvulsant, potent hexobarbitone hypnosis and anti-amphetamine effects. In this study the results showed a cardiac stimulant, a depressor, part of which mediates beta adreno receptor stimulation and partly a direct musculotropic effect.[13]

Antimicrobial activity: Bhaskar Rao et al. studied that the antimicrobial activity of aqueous extract of *E.ganitrus* leaves was tested against clinical breakdown of bacteria and fungi. In vitro antimicrobial activity was mediated by the efficient distribution of agar to Mueller Hinton agar and Sabouraud Dextrose agar of bacterial and fungal cultures respectively. The extract has shown significant antimicrobial activity as it inhibits the growth of *Staphylococcus aureus, Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoniae, Penicillium sp, Aspergillida flavus, Candida albicans and C.tropicalis*. The extract showed a significant percentage of related inhibition against *B. cereus* (124.16%). A small concentration of inhibitory inhibition concentrations was performed in the form of a fine agar distribution. The minimum concentrations of the excretion inhibition vary from 125-2000 µg / ml; however a small amount was reported against *B.cereus* and *A. flavus* (125µg / ml). The results indicate the potential use of *E.ganitrus* leaves for the development of antimicrobial compounds.[14]

Antioxidant activity: For determining the antioxidant capacity, reducing power, metal chelating, ABTs+ (2, 2- azinobis- (3-ethylbenzothiazone-6-sulphonate) radical scavenging and hydroxyl scavenging activities, the ethanolic extract of *E.ganitrus* leaves was analyzed. The totalantioxidant capacity was found to be 24.18mg ascorbic acid equivalent at 500 µg/ml in extract concentration.There was a good relationship between the phenolic content and antioxidant capacity, R2 = 0.8547, and relation between the amount of flavonoids and antioxidant capacity was determined to be R2=0.8413. They suggest that phenolics and flavonoids in the leaves are very effective antioxidant activity.[10]

Antihypertensive activity: In the study of Sakat, "The aqueous seeds extract of *Elaeocarpus ganitrus* show antihypertensive effect on renal artery occluded hypertensive in male wistar rats, due to the action on rennin-angiotensin system."[15]

Immunomodulatory and Nephroprotective activity

In the study of Kakalij et al., Ethanolic extract of *E.ganitrus* seeds has both immune and nephroprotective activity. Simultaneous administration of *E.ganitrus* significantly reduced high level of serum creatinine, BUN, uric acid, and albuminuria with significant increase in serum albumin and urine creatinine. In addition *E.ganitrus* significantly increased serum protein levels and antioxidant enzyme levels by significant changes in the phagocytic index and neutrophil adhesion tests compared to the dose-treated GM group.[16]

Anti-atherosclerotic activity

In the study of Jain et al., the anti-atherosclerotic activity of 70% ethanolic seed extract (EEGS) of *E.ganitrus* in cholesterol fed rabbits. Phytoconstituents such as alkaloids, tannins, flavonoids, steroids, triterpenoids, and carbohydrates in the ethanolic extract may be attributed to the effective anti-atherosclerotic and antioxidant activity of the extract plant. Studies have shown that the release of EEGS can be a powerful therapeutic alternative in the treatment of atherosclerosis and hypercholesterolemia-related diseases.[17]

Anti-inflammmatory activity

The bark extract of *E.ganitrus* has shown anti-inflammatory activity through the HRBC method of strengthening the membranes. The HRBC membrane is equivalent to the lysosomal membrane which play a role in the inflammatory process. The in-vitro HRBC membrane strengthening method has shown significant properties in preventing inflammation of various tested *E.ganitrus* extracts. It has been found that the chloroform extract indicates

significant anti-inflammatory activity at a concentration of 500 µg/ml compared with standard Diclofenac sodium.[18]

Antidiabetic activity

The aqueous seed extract of *Elaeocarpus ganitrus* (EAG) shown potential antidiabetic effects in experimental animals. The hypoglycemic effect of *E.ganitrus* may be attributed to alkaloids, viz. rudrakine, (-)elaeocarpine and (-)iso-elaeocarpine, flavonoids and glycosides. The study shows that EGA seeds have an antihyperglycemic activity in STZ-induced diabetic rats. However, further studies should be undertaken to identify the active hypoglycemic compounds and investigate the mechanism of action of the hypoglycemic activity of *E.ganitrus*.[19]

According to Rao, *E.ganitrus* also demonstrates the antidiabetic effect possible with chitosan based aqueous extract by producing hypoglycemic effect in normal rats.

Antianxiety activity

Petroleum ether (PE), chloroform (CE), ethanol (EE) and liquid extractives (WE) of *E.ganitrus* were prepared and tested for anti-anxiety activity in mice using a highly sophisticated corn model. The results were compared with a common drug, diazepam. Chloroform and ethanol extract of *E.ganitrus* (200 and 400 mg / kg) significantly increased the time spent and the percentage of open arm insertion in the higher maize model and implied that it showed anti-anxiety activity, which was comparable to diazepam. Chemically, plant extracts showed the presence of phytosterols, fats, alkaloids, flavonoids, carbohydrates, proteins and tannins. The anxiolytic effects of chloroform and ethanol extract of *E.ganitrus* may be related to alkaloid and flavonoid content. The results suggest that this plant may be considered a potential alternative to the targeted bioactivity classification of natural anti-anxiety agents.[20]

Other activities

The Ethanolic fruit extract of *Elaeocarpus ganitrus* exhibit sedative, anti-inflammatory, sedative, calm and anti-epileptic properties.[14]

Table no. 01: Different species of *elaeocarpus* genus show different activity.[10,21-25]

Species	Activity
Elaeocarpus floribundus	The combination of the bark, leaf and stem of *E.floribundus* has been used as a mouthwash and the fruit has been used as a disinfectant.
Elaeocarpus grandis	Indolizidine alkaloids grandisine A and isoelaeocarpiline compounds interact with the opoid receptor and have analgesic effect.
Elaeocarpus mastersii	Chloroform soluble bark extract of *E.mastersii* has been shown to show significant cytotoxic activity when examining human cell cancer cell line panel. Cucurbitacin D, cucurbitacins and cucurbitacin F isolated from *E.mastersii* showed a cytotoxic effect alongside KB (human oral epidermoid carcinoma).
Elaeocarpus serratus	Ethanolic leaves extract of *E. serratus* showed Cytotoxic activity of plant extracts against brine shrimps.
Elaeocarpus grandiflorus	Rahman and Bualee showed that water extract of fruits, leaves and twigs of *E.grandiflorus* often used to treat patients with diabetes.

CONCLUSION

It concludes with the above that various bioactive extracts prepared from *Elaeocarpus ganitrus* roxb. In the traditional medicine system, various components (beads, fruits, leaves and seeds) of Rudraksha are taken to reduce various health problems such as mental disorders, headaches, fever, skin diseases and wound healing. Phytosterols, fats, alkaloids, flavonoids, carbohydrates, proteins and tannins have been found to have a significant effect on *E.ganitrus* healing properties.

Elaeocarpus ganitrus (Roxb) contains important phytochemicals such as triterpenes, tannins, indolizidine alkaloids grandisine, elaeocarpiline, gallic acid, ellagic acid and flavonoids quercetin which show many therapeutic activities including antioxidant, hypoglycemic antidepressant, antianxiety, antihypertensive, antimicrobial, Nephroprotective and other.

By many ethnomedicinal and scientific properties, *Elaeocarpus ganitrus* considered as valuable (precious) plant that offers a list of benefits.

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