Environment Conservation Journal 13(3) 147-150, 2012
ISSN 0972-3099 (Print) 2278-5124 (Online)
Abstracted and Indexed

A comprehensive report on therapeutic potential of *Elaeocarpus ganitrus* Roxb. (Rudraksha)

Swati Joshi, Payal Gupta, Navin Kumar✉, Nishant Rai, Pankaj Gautam, Ashish Thapliyal

Received: 16.04.2012 **Revised: 17.07.2012** **Accepted: 21.09.2012**

Abstract

Members of family Elaeocarpaceae are known for its medicinal properties since long back in traditional medicinal systems. Along with its medicinal usage it has also got spiritual importance due to its electromagnetic nature and mythological convictions. Elaeocarpus ganitrus Roxb. is commonly known as Rudraksha in India. Phytochemical analysis has revealed the presence of many pharmaco-active constituents like tannins, flavonoids, alkaloids, carbohydrates and acids in different extracts of plant parts. Several studies have been done to explore the pharmacological activities of different extracts of the members of Elaeocarpaceae family specially Rudraksha. In this review, we have tried to consolidate the available reports on the phytochemical constituents, and pharmacological properties of Elaeocarpus species.

Keywords*: Rudraksha, Elaeocarpus ganitrus, Antioxidant property, Antihypertensive agent, Antifungal property, Anxiolytic property, phytochemical constituents, MIC*

Introduction

Elaeocarpus species belong to the family Elaeocarpaceae.This family contains approximately 350 species, which are distributed in India, Southeast Asia, Malaysia, Southern China, Japan, Australia, New Zealand, Fiji and Hawaii. It is a large evergreen broad leaved tree which grows in the area from the gangetic plain to the foothills of great Himalaya. Tree has a pyramidal shape. Flowers are white and inflorescence is raceme. Tree starts giving fruits in 7 years. Fruit is drupe. Stone beads are enclosed by a outer shell of blue colour, on ripening hence sometimes it is also called as blueberry beads. Beads are hard in nature. It is growing in suitable climatic regions with temperature ranges of 25-30^{0}C. *Elaeocarpus ganitrus* (syn. *E. sphaericus*) is the most studied members of the family for their pharmacological properties. *E. ganitrus* is grown in Assam and Himalayan region in India. Here, we have consolidated the pharmacognostic and pharmacological information available in research articles on the members of family Elaeocarpaceae mainly *Elaeocarpus ganitrus* (Rudraksha). *E. mastersii* is the native of Malaysia and Indonesia is known for its anti tumour properties.

Systemic Classification-

Kingdom	Plantae
Division	Magoliophyta
Class	Magnoliopsida
Order	Oxalidales
Family	Elaeocarpaceae
Species	*E. ganitrus*

Traditional therapeutic significance:

Different parts of plant are being used in Ayurveda since long back for the treatment of mental diseases, epilepsy asthma, hypertension, arthritis and liver diseases. It is also used for skin diseases, leprosy, hysteria, coma, leucorrhoea etc. Due to its electromagnetic nature, wearing a Rudraksha is also helpful in controlling B.P., stress, anxiety and depression. Fruits are also used as antipyretic agent to control the fever, to treat malaria *(Bhattacharya SK et al., 1975),* dysentery, diarrhea and typhoid. Leaves of Rudraksha are used in the treatment of rheumatism and its bark is useful in vomiting of blood. It also helps women during conceiving a child and also useful for those female which are prone to abortion. It is also used to cure for prolonged cough. Powder of the plant with black

Author's Address
Department of Biotechnology, Graphic Era University, Dehradun, Uttarakhand, India
E-mail: navinbajpai@gmail.com

pepper is also used to cure smallpox *(Shah G. et al., 2010)*. Rudraksha fruits are also useful in cough, bronchitis, neuralgia cephalgia, anorexia, migraine manic conditions and other brain disorders. Flesh of drupes is also used in treatment of epilepsy *(Dasgupta A. et al., 1984)*.

Active constituents

Active constituents present in Rudraksha are elaeocarpidine, elaeocarpine, rudrakine, flavonoids quercetin (Johns SR., et al., 1971, Ray AB., et al., 1979, Chand L., et al., 1977). Extracts shows presence of phytosterols, fat, alkaloids, flavonoids, carbohydrates, ethanol, proteins and tannins, gallic acid and ellagic acid. It contains 50.03% C, 0.95% N, 17.89% H, and 30.53% O_2. Phytochemical investigation with different extracts shows different kind of chemicals. extraction with petroleum ether shows presence of fixed oil fats and phytosterols. Extraction with ethanol ether shows presence of alkaloids, flavonoids, carbohydrates, proteins, tannins. Extraction with water shows presence of, carbohydrates, proteins, tannins. Elaeocarpus sphaericus yields mainly indolizidine alkaloids. Alkaloids including isoelaeocarpine, epiisoelaeocarpiline, epielaeocarpiline, alloelaeocarpiline and pseudoepiisoelaeocarpilline. (Singh & Chopra et al., 2011).

Pharmacological Activities:

Antioxidant properties:*Elaeocarpus ganitrus* are reported to possess promising antioxidant capacity. Phytochemical analysis has revealed that different extracts contain constituents like flavonoids, polyphenols, biflavones, tanins and phenolic compounds etc. Experiments have shown that etanolic extract (EE) is found to have 24.18 mg ascorbic acid equivalents at 500 µg/ml extract concentration proving antioxidant activity of extracts. Reducing power of a compound also reflects its potential of antioxidant capacity Reducing power of tannins prevents liver injury by inhibiting the formation of lipid peroxides. Reducing power of EE ranged from 1.112 to 1.973 Abs (arbitrary unit) for 100□g/ml to 400□g/ml concentration. Metal chelating agents reduce the concentration of catalyzing transition metal in lipid peroxidation by forming sigma bonds with metals, reducing redox potential thereby stabilizing the oxidized form of the metal ion. There is a positive relationship with antioxidant properties and concentrations of flavonoids & polyphenols. Maximum the quantity of flavonoids and polyphenols maximum the antioxidant capacity. Total phenolic compounds of *E.ganitrus* are 56.79 mg gallic acid equivalent/g of dry material. Total flavonoids present are 18.58 mg equivalent/g of dry material. (Kumar TS., et al., 2008)

Antifungal activity: Different extracts of dried Rudraksha beads [petroleum ether extract (PE), chloroform extract (CE), ethanol extract (EE) and water extract (WE)] have shown different Minimum Inhibitory Concentrations (MIC) for different strain of fungi like *Candida albicans*, *Candida tropicallis* and *Aspergilus niger*. MIC for CE was found to be 1.5 mg/ml followed for EE i.e. 4.0 mg/ml for *C. albicans.* MIC for CE was 5.0 mg/ml when investigated for *C. tropicallis*. *C. tropicallis* did not show any sensitivity against WE and EE. MIC of CE and EE for *A. niger* was 3.0 mg/ml followed by WE (MIC 5.0 mg.ml) and no inhibition was shown for *C.glabrata* and *G.candidum* even at higher concentrations (Singh et al 2010).

Antibacterial activities: Extracts of fruits of Elaeocarpus sphaericus in petroleum ether (PE), benzene (BE), chloroform (CE), acetone (AE), and ethanol (EE) were tested for its bactericidal properties. Several bacterial strains (*Staphylococcus aureus, Enterococcus faecalis, Bacillus subtilis, Salmonella typhi and paratyphi, Salmonella typhimurium, Vibro cholera, Aeromonas hydrophila, Shigella sp., Klebsilla pneumonia, Enterobacter sp. And Pseudomonas sp.* etc.) were found to be sensitive to the exposure of these extracts (Singh RK and Nath G, 1999).

Anxiolytic effects: Shah Gagan et al., 2010, have investigated the anxiolytic effect of methanolic extract (ME) of Rudraksha fruit by Elevated plus-maze (EPM) assay and found that magnitude of the anxiolytic effects of 200mg/kg of ME of Rudraksha fruit was close to that observed with 0.5 mg/Kg of diazepam. ME prolonged the ketamine-induced latency to sleep. ME was also found to affect locomoter activities. Thus these results support the traditional use of plant in management of anxiety. *(Shah G. et al., 2010).*

Anticancer agent:Chloroform soluble extract from bark of *Elaeopcarpus mastersil* from Malaysia has shown significant cytotoxic activity against human cancerous cell lines (human oral epidermoid carcinoma cell line). Phytochemical analysis revealed the presence of ellagic acid and curarbitacin from bark which have shown an effective cytotoxicity against tumour cells (Ito A. et al., 2002).

Antihypertensive agents: Aqueous extract of seeds of *Elaeocarpus ganitrus* have decreased the mean arterial blood pressure at the dose level of 25, 50 and 100 mg/kg in models Male Wister rat and Swiss albino mice. The activity may be due to the action on rennin angotensin system. (Sakat SS et al., 2009).

Antidiabetic activity: Extract of plant has been shown to have anti hyperglycemic activity in a dose dependent manner. STZ (Streptozotocin) induced hyperglycemia in rats was shown to be reduced by the extract but was not able to restore the blood glucose level to the baseline value. The results were given so as to use the plant extract with alternative for diabetic control. (Hule & Juvekar et al, 2011).

Anti-asthmatic activity: Different extracts of E. sphaericus fruit (PE, BE, CE, AE and EE) are reported to have protective role in bronchial asthma. In vitro experiments have shown that fruit extracts have rat mesenteric mast cells stabilizing activities (Singh RK, et al., 2000).

Anti-inflammatory and Analgesic activities: Jaspreet Nain and group (Jaspreet N. et al., 2012) have investigated the analgesic and anti-inflammatory properties of different extracts of *E. sphaericus* leaves by carrageenan-induced paw oedema in rats and tail flick tests in mice. Methanolic and aquous extracts have shown promising anti-inflammatory activities at the doses of 50, 100 and 200mg/kg. Diclofenac sodium at an concentration of 5mg/kg was used as positive control.

Some studies have also reported the cardio-protective *(Sarkar PK et al., 1972 and 1973)* and nootropic (increasing learning and memory) activities of methanolic extract of *E. ganitrus* in animal models.

Conclusion

It is clear from the above mentioned pharmacological properties of Rudraksha that the different extracts from different parts of the plant have got enormous therapeutic potential. Now the studies are required to establish the biological/pharmacological roles of specific active principal of the extracts by in vitro and in vivo assays. Toxicological assays, as per the regulatory guidelines (ICH version 2, 2008, WHO and Indian guidelines) should be followed to develop the novel drug product. Guidelines and protocols are available in Ayurvedic Pharmacopoeia of India 2011 to develop an Ayurvedic drug.

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