



Elaeocarpus ganitrus (Rudraksha): A Drug with Spiritual and Medicinal Properties

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Abstract

Rudraksha plant is considered as the most popularized plant which is used for its spiritual and medicinal properties. It is known as the King of herbal medicines which is used both as a curative and preventive form in all the Indigenous medicinal systems i.e. in Ayurveda, Siddha and Unani medicinal system. As per Hindu mythology, it is believed that the plant is originated from the tears of Lord Shiva. From ancient times, Rudraksha beads have been attracting the attention of not only ordinary human beings but also the sages, scientists and physicians because of their attributes and powers. Traditionally, the plant is used to cure diseases like blood pressure, neurological disorders, asthma, diabetes, and other reproductive disorders. The plant has a specific effect on the heart and circulatory-related disorders because of the presence of electromagnetic properties. It carries great ornamental value and is used as necklaces, bracelets in the Hindu Culture. Traditionally, the Rudraksha plant is used to cure diseases like stress, anxiety, palpitation, depression, nerve pain, migraine, insomnia, pimples, ringworm, epilepsy, asthma, lack of concentration, arthritis, hypertension, and liver diseases. Rudraksha plant possesses various pharmacological properties and act as an analgesic, antidepressant, antidiabetic, anticonvulsant, cardio-stimulator, hydrochloric, antiaging, antiseptic, anticonvulsive, antihypertensive, hypnotic, antiepileptic, tranquilizing, anti-inflammatory, thermogenic, sedative, smooth muscle relaxant and hydrocholeretic agent.

Keywords

Elaeocarpus ganitrus, Ayurveda, Rudraksha, Folk View, Pharmacological uses.

INTRODUCTION

Elaeocarpus ganitrus (as shown in Figure No. 1) also known as Rudraksha in Sanskrit or rudraki in Hindi is considered as one of the most important herbal plant found in the Indigenous medicinal system including Ayurveda, Siddha and Unani. The ripe fruit of the *E. ganitrus* plant consists of hard stony endocarp, which is known as bead, nut, or Rudraksha [1]. Rudraksha is known as the King of herbal medicines which is used for sacred, spiritual and medicinal purposes. Rudraksha is a dried herbal fruit that is originated in the foothills of the Himalayas. It is considered as the most sacred and spiritual plant in the Indian medicinal system which carries great medicinal

importance both as a curative and preventive form [2]. *E. ganitrus* holds a specific position in the Hindu religion and is described in the ancient literature of Shiv Puran, Devi Bhagwat Puran, Padmapurna and Ayurveda [3]. *Elaeocarpus* is derived from the Greek word which is a combination of the two words named Elai and Carpus where Elai means 'wild olive' and carpus meaning fruit. Hence, the seeds of wild olive-like trees are called *Elaeocarpus*.

As per Hindu mythological beliefs, Rudraksha is the beloved tree of Lord Shiva which is originated from the tears of Lord Shiva. Rudraksha is the combination of two words where Rudra means Lord Shiva and aksha meaning eye. Fruits or beads of this plant are

used in daily worship for counting prayers and consist of different magical properties. It is also used as necklaces, bracelets in the Hindu Culture. Traditionally, the Rudraksha plant is used to cure diseases like stress, anxiety, palpitation, depression, nerve pain, migraine, insomnia, pimples, ringworm, epilepsy, asthma, lack of concentration, arthritis, hypertension and liver diseases [4]. In Ayurveda, it is believed that the wearing of Rudraksha beads (figure no. 1) has a positive effect on the heart and nerves and is also used to cure psychosomatic diseases [5,6]. Also, Ayurveda practitioners use Rudraksha beads, bark and leave to cure diseases like mental disorders, headache, infertility, epilepsy, piles, ulcers, hysteria, coma, snakebites, fever and skin diseases. Besides this, Rudraksha beads possess numerous powers and help in empowering the heart and circulatory system due to the presence of diamagnetic properties,

electrical properties, bioelectric circuits and electromagnetic character [7]. Various phytochemical constituents extracted from the leaves, bark, root and fruit of the Rudraksha plant possess different pharmacological and therapeutic properties. It is also believed that the pharmacological and therapeutic properties of the Rudraksha plant differ from one another based on the grooves or mukhis present on it [8,9]. Rudraksha plant acts as an analgesic, antidepressant, antidiabetic [10], anticonvulsant, cardio-stimulator, antiaging, antiseptic, anticonvulsive, antihypertensive, hypnotic, antiepileptic, tranquilizing, anti-inflammatory, thermogenic, sedative, smooth muscle relaxant agent [11,12]. The vernacular name and toxicological classification are shown in table no. 1 and table no. 2 respectively.



Figure 1 *Elaeocarpus ganitrus* (Rudraksha)

Table 1 Taxonomical Classification of Rudraksha [13]

Taxonomical rank	Taxon
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliophyta
Order	Oxalidales
Family	<i>Elaeocarpaceae</i>
Genus	<i>Elaeocarpus</i>
Species	<i>E. ganitrus</i>
Common name	Rudraksha

Table 2 Vernacular names of Rudraksha [14]

Sanskrit	Chattu sampangi, Rudraksha
Hindi	Bhutnasan
English	Utrasum Bead Tree, Wooden
Gujarat	Rudraksh
Bengali	Rudrakya
Kannada	Rudrakshi mara, Rudraksh
Malayalam	Rudraksha, Rudraksam
Marathi	Rudraksha
Punjabi	Rudraksha
Tamil	Rudraksha, Ruttiratcam
Telgu	Rudraksha, Rudrakshi
Assam	Rudrai, Ludrok, Udruk
Other	Sivaksha, Sarwaksh, Paawan, Nilkanthaksha, Haraksha, Sivpriye

Table 3 Rasapanchak (properties) of *E. ganitrus* plant [36]

Sanskrit / English	Sanskrit / English
Veerya / Potency	Sheet / cold, Ushna / hot
Vipak / Metabolic property	Madhur / sweet
Guna / Physical property	Guru / heavy, Snigdha / oily
Rasa / Taste	Madhur / sweet

Table 4 Types of Rudraksha and its traditional and astrological Uses

Types of Rudraksha	Healing effect	Astrological uses
1 faced/Shiva	Mental anxiety, chronic asthma, cardiovascular diseases, stroke, eye problem, headache and bone pain Renal failure, impotency, anxiety, lack of concentration,	It enlightens the super consciousness, grants improved concentration. The wearer enjoys all comforts at his command but remains unattached.
2 faced/Ardhnareshwar	depression, stress, mental chaos, hysteria, eye problem, negative thinking and intestinal disorders Depression, jaundice, mental disability, menstrual stress/cycle, schizophrenia,	Blessed with UNITY and is related to husband-wife, guru-shishya, parents-children. Its main peculiarity is maintaining oneness.
3 faced/Agni	blood pressure, weakness multifarious, guild induced complexes, mood swings, fever or weakness	It makes the person free from all the sins of their life. Wear by those who feel inferior complex, fear, guilt, depression.
4 faced/ Brahma	Respiratory problem, cough, brain disorder, blood	Increases memory power and intelligence, give power of creativity.

	circulation, asthma, hesitation, memory lapse	
5 faced / Kalaagni	Diabetes, piles, blood pressure, stress, mental disability, anger issues, neurological, heart problem	Gives health, peace and enhance memory power.
6 faced/ Kartikey	Epilepsy and reproductive problems	It saves the person from emotional trauma, sorrows, gives knowledge, learning and wisdom. It affects appreciation of love, understanding, sexual pleasure, music and personal relationship.
7 faced/ Mahalaxmi	Impotency, confusion asthma, pharyngitis, anorexia, respiratory disorders	Wear by those who are suffering from miseries, finance problem and mental disorder. Wearing this bead helps in progressing business and service.
8 faced/ Ganesha	Skin diseases, anxiety, stomachache	It brings success to one's life and remove all the hurdles from his life. It gives the wearer all the Riddhies and Sidhies.
9 faced/Durga	Mysterious diseases, strange diseases	Blessed with great energy, powers, fearlessness, dyanamism, which helps in living a life of success.
10 faced/ Vishnu	Whooping cough, mental insecurity, hormonal imbalance	Works as a shield on one's body from all the evils.
11 faced/ Hanuman	Liver diseases, chronic alcoholism, body pain, backache	It provides wisdom, powerful vocabulary, right judgement, adventurous life, fearlessness success to the wearer. It protects the person from accidental deaths and helps in meditation.
12 faced/Sun	Osteoporosis, mental disability, bone diseases, rickets, anxiety	It provides the quality of sun to the wearer like strength, brilliant radiance. Beneficial for ministers, politicians, administrators and businessman. It removes worry, fear, suspicion and increases self-motivation and self-image.
13 faced/Indra	Muscular dystrophies	It provides honor, money and fulfill all the desires of the person. It also helps in meditation, spiritual and materialistic attainments.
14 faced/ Hanuman	Brain disorders	Most precious Gem called as Deva mani. It activates the sixth sense of the person which helps the person foresees the future happenings. The wearer never fails in their decisions and get rid of all the miseries, worries and calamities. It provides shield to a person which protects the person from evil spirits, ghosts and black magic. It provides self-power, security and riches to the wearer.
15 faced/ Pashupatinath	Infertility, skin diseases	It provides economic progress to the wearer.
16 faced/Hari and Shankar	Tuberculosis, leprosy, lung disease	The wearer remains unaffected from heat and cold mainly used by saints.
17 faced/Lord Vishwakarma	Memory lapse and body dysfunction	Represents the builder of this world- Lord Vishwakarma. It helps in gaining unexpected money.
18 faced Bhairav	Mental peace	Represents the mother earth. It is useful for pregnant women in protecting their child. It makes the person happy and healthy.
19 faced/ Vishnu narayan	Blood and spinal disorder	Represents the Lord Narayana. It provides worldly pleasure to the wearer.
Trijuti or Tribhagi/ Brahma, Vishni, Shiva	Helpful in treating internal and external disorders	Wearer becomes invincible.

Gauri Shankar/ Shiva and Parvati	Helpful in treating sexual disorders	Provide peace and comfort in the family.
Garbha gauri/ Parvati and Ganesha	It helps in treating reproductive disorders.	It helps women wanting to have children.

Table 5 Reported therapeutic and pharmacological properties of *E. ganitrus* plant

S. No.	Extract	Method (<i>In vivo</i> / <i>In vitro</i>)	Pharmacological activity	Reference
1.	Petroleum ether, chloroform, methanol, and aqueous extract	Mice	Analgesic and anti-inflammatory	[50,51,52]
2.	Ethanol extract	-----	Antioxidant	[53]
3.	Aqueous extract	Wistar albino rat, Swiss albino mice	Antihypertensive	[54,55,56]
4.	Aqueous extract	<i>Staphylococcus aureus</i> , <i>B. cereus</i> , <i>E. coli</i> , <i>Pseudomonas aeruginosa</i> , <i>Klebsiella pneumonia</i> , <i>Penicillin sp</i> , <i>Asperigillus flavus</i> , <i>Candida albicans</i> , <i>C. tropicalis</i>	Antimicrobial	[57,58]
5.	Petroleum ether, chloroform, ethanol and aqueous extract	Mice	Antianxiety	[59]
6.	Aqueous extract	Rat, Swiss albino mice	Antidiabetic	[60,61]
7.	Chloroform & ethanol extract	<i>Candida albicans</i> , <i>Asperigillus niger</i>	Antifungal	[62]
8.	Petroleum ether, benzene, chloroform, acetone and ethanol extract	<i>Staphylococcus aureus</i> , <i>E. faecalis</i> , <i>Bacillus subtilis</i> , <i>Salmonella typhi</i> , <i>Salmonella typhimurium</i> , <i>Vibrio cholera</i> , <i>Aeromonas hydrophilla</i> , <i>Shigella sp.</i> & <i>Pseudomonas</i>	Antibacterial	[63]
9.	Ethanol	Mice	Antidepressant	[64]
10.	Petroleum ether, benzene, chloroform, acetone, ethanol	Rat	Anti-asthmatic	[65]

COMPOSITION OF RUDRAKSHA:

Rudraksha bead consists of carbon, hydrogen, nitrogen, oxygen and trace elements

Carbon: 50.031%

Nitrogen: 0.95%

Hydrogen: 17.897%

Oxygen: 30.53%

BOTANICAL DESCRIPTION OF *E. GANITRUS* PLANT

Rudraksha is a large, woody, perennial, pyramid-shaped, evergreen tree with a large spreading crown that belongs to the *Elaeocarpaceae* family. The height of this plant reaches up to 50-200 feet [15]. The trunk is cylindrical with greyish white and rough-textured bark. The morphological description of the parts of the Rudraksha plant is shown below.

Leaves: Leaves are simple, large, glabrous, oblong-lanceolate, acute or acuminate, sub-entire or irregularly crenate, shining green on the sun-facing side and dull stringy on earth facing side with length 5-6 inches and breadth 2 inches [16].

Flower: Flowers of the Rudraksha plant are sweet-smelling, pointed, elongate, about 1-2 cm in diameter densely racemes mainly from the axils of fallen leaves, white or yellow, linear anther, and fringed petals. Flowering started in the April to May month [17].

Fruits: Fruits are small, fleshy, acidic, round or oval, violet or blue bearing (blueberry bead) a centrally located seed containing a bead called Rudraksha. They start appearing in June and ripen near October [18]. It starts giving fruit after 7 years from the day of sowing. The diameter of a standard fruit is about 1.3-2cm.

Endocarp: It is hard, stony, strongly tubercular, globular, reddish-brown having 5 longitudinal ridges sometimes 1 to 4 with a diameter 14-17mm [19,20].

GEOGRAPHICAL DISTRIBUTION

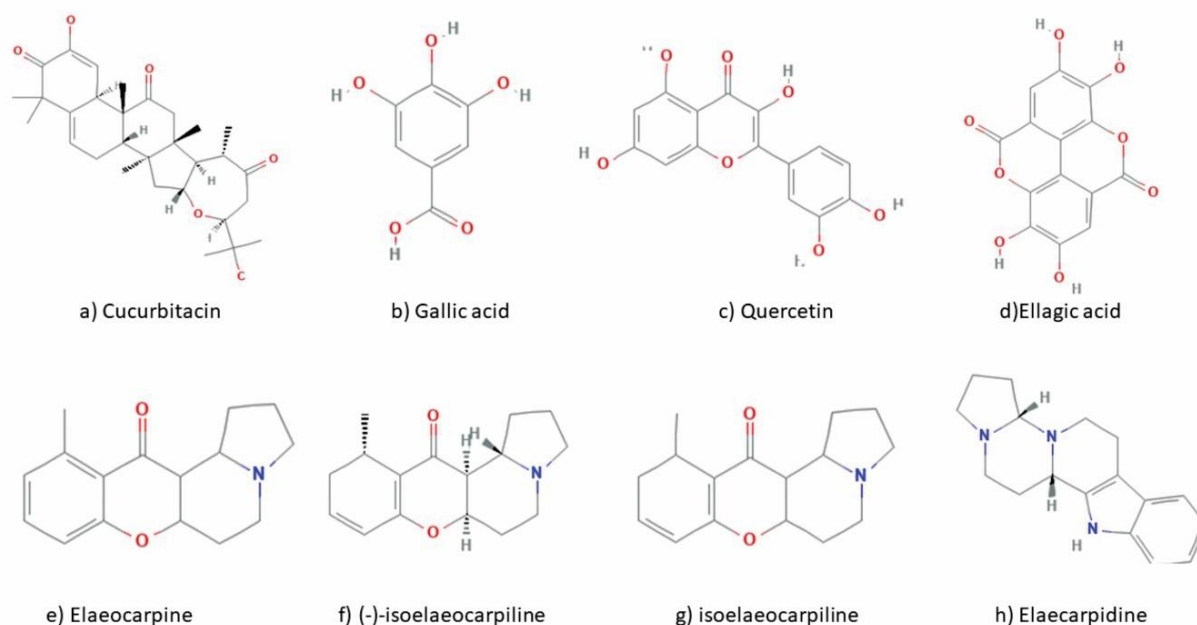
E. ganitrus plant is a native of the Indonesian region. Rudraksha tree is mostly grown in humid evergreen forests characterized by three-tier forest structure and grown from the Gangetic plain to the foothills of

the great Himalayas. *Elaeocarpus ganitrus* is mainly found in the tropical and sub-tropical regions at an altitude of 2,000 meters above sea level [21]. *Elaeocarpus ganitrus* is distributed in the Madagascar region, Bangladesh, Bhutan Nepal, Bengal, India, Malaysia, Southern China, islands of Borneo, New Guinea, Java, Sumatra, Bali, Iran, Japan, Southeast Asia, Australia to New Zealand, Fiji and Hawaii in the east [22]. In India, the Rudraksha plant is mainly distributed in the southwestern borders of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Haryana and states of Assam, Bihar, Bengal, Maharashtra, Madhya Pradesh Sikkim and Arunachal Pradesh [23]. 70% of the Rudraksha trees are found in the Indonesia region, 25% in Nepal while 5% in India. Rudraksha plant comes under the list of RDB (Red Data Book) where it is considered as an endangered species in the northeastern region of India [24].

PHYTOCHEMICAL CONSTITUENTS

The various phytochemical constituents found in *E. ganitrus* fruits are glycosides, alkaloids and

flavonoids as per the reported studies [25]. The exocarp of the fruit contains carbohydrates (21.0% dry mass, or 0.58g per fruit) and proteins (4.3% dry mass, or 0.12g per fruit). The indolizidine alkaloids present in *E. ganitrus* plant have gained much attention due to their significant glucosidase activity and are used in the treatment of cancer, diabetes and HIV [26]. Steroids or cucurbitacins are also present in the Rudraksha plant that acts as a cytotoxic agent [27,28]. The ethanolic extract of the plant leaves consists of gallic acid, quercetin and ellagic acid [29]. The C16-dione aromatic alkaloids were also found as a minor constituent in the Rudraksha plant namely elaeocarpine and isoelaecarpine. The other chemical constituents reportedly found are (+)-elaecarpiline, isoelaecarpiline, (-)-epi-elaecarpiline, (+)-epi-isoelaecarpiline, (+)-epialloelaecarpiline, (-)-alloelaecarpiline, elaeocarpidine and pseudoepi-isoelaecarpiline containing dihydro-gamma-pyronechromophore in its molecule [30]. A non-aromatic indolizidinealkaloid named rudrakine $C_{16}H_{23}NO_3$ was extracted from the leaf part of



Rudraksha plant which is of biological significance [31]. The chemical structures of some of the phytochemical constituents is shown in Figure No. 2.

Figure 2 Chemical structures of some major phytochemical constituents of Rudraksha plant

TRADITIONAL AND MODERN VIEW OF *ELAECARPUS GANITRUS*

a) Ayurvedic View: Rudraksha plant is known as the King of Herbal medicines. The bead leaves and bark of the Rudraksha plant are used to cure diseases like dahashaman (burning sensation) in the paste form, swasroga (bronchial antispasmodic), jwar (fever), apasmar (epilepsy) and matisudhikara (cure mental condition) skin diseases like measles, sores, boils, ringworm and pimples. It helps in calming the mind and cool down the body temperature. The seeds of Rudraksha plant has a positive healing effect on the neurological, circulatory disorder and is used in acupuncture and magnetic therapies. The bead of the Rudraksha plant is used to balance the important vital chakras of the human body i.e. Vata (gas), Pitta (bile) and Kapha (phlegm) components. It is also used in various cosmetic products. Wearing Rudraksha bead cures anxiety, stress, strain, insomnia, depression, infertility, boosts self-confidence, mental stability, rheumatism, asthma, hypertension, palpitation, lack of concentration and has a positive effect on nerves and heart as per the Ayurvedic medicinal system [32]. The three-faced Rudraksha bead helps in curing frequent fevers in children. In Ayurveda, the seeds and fruits of the Rudraksha plant are used to cure psychosomatic disorders, fever, headache and possess electromagnetic and inductive properties which balance and control the flow of bio-electric current in the body [33]. There are different types of Rudraksha based on the number of grooves or mukhis present on it which possesses different properties. For example, five-faced Rudraksha has an antihypertensive property that helps in controlling blood pressure. The decoction of ten-faced beads, when taken with milk, cures cough. Boiling four-faced Rudraksha bead with 1 glass of milk has a positive effect on manasroga patients (mental disorders) and poor memory. A particular Mukhi of Rudraksha bead provides resistance to the body by sending a particular type of biochemical in the brain which activates specific positive changes in the personality, confidence and positivity in the mood of a person. The rasapanchak (properties) of *E. ganitrus* plant is shown in table no. 3

Formulations of *E. ganitrus*: The different formulation of the *E. ganitrus* plant include Gorochanadi Vati, Mrtasanjivani gutika, Svarnamukladi gutika, Dhanwantara gutika, Cukkumitppalyadi gutika [34], Rudraksha churna, Rudraksha hima (cold infusion), Rudraksha Milk, Rudraksha decoction (gargling), Rudraksha Lehyam, Rudraksha Vibhuti, Rudraksha oil, Rudraksha eyedrops, Rudraksha paste and Rudraksha bhasma [35].

Actions and properties of Rudraksha [37,38]

The uses of Rudraksha plant as per Ayurveda is described below:

“रुद्रक्षाय प्लास्थि स्यान्मधुराम सीतलमलघु
मोनोविकारसमनाम रक्ताभरणहम
सरम दहेजवाराप्रस्माणां सस्यते वातपैत्तिके अपस्मार
तथोन्मादी
रक्तभारे ढीके तरसी मसूरिकायम विसोफोटे सवसे
यकृद्गादेसु का”

Raksoghna: It acts as a disinfectant for various microbial diseases.

Medya: It enhances the memory and intellectual power of the person [39].

Hridyam: It is given as a cardi tonic to cure heart diseases.

Vataghna: It balances the Vata component and helps in treating chest pain and early symptoms of rheumatic pain.

Kaphanashak: It balances the Kapha dosha and hence is used to cure the early stages of asthma and used to treat allergies, obesity, swelling and rhinitis.

Shirathi Shamanam: It is used to treat migraine.

Ruchyam: It is used to cure stomach-related disorders like indigestion, gases and tastelessness. Rudraksha decoction shows a positive effect against heaviness, tongue cracks, etc.

Bhutagrah Vinashanam: It is used to cure mental disorders, bad effects of evil spirits and planetary afflictions.

Vedanasthapan: It is used as an analgesic.

Pachansansth: It regulates the peristaltic movement and helps in treating liver disorders.

Raktwahsansth: It is used to treat hypertension and acts as an anti-hypertensive agent.

Shwasansansth: It acts as a bronchodilator and is used to cure cough and other breathing problems like asthma.

Taapkaram: It acts as an antipyretic agent. The paste of Rudraksha and Chandan plant has an effective result in the treatment of measles, pimples, chickenpox and other skin-related diseases.

Manasvikar: It is used to treat mental disorders, provide mental peace and cure psychosomatic diseases and enhance memory power [40].

Aakshepak: It is used to treat epilepsy problems.

Aaptantrak: It is used to treat hysteria.

Anidra: It is used as a curative agent against insomnia.

Yakritvikar: It is used to cure liver disorders by increasing metabolism.

Kamla: It is used to treat jaundice [41].

Rakta-chaap: It is useful in the treatment of blood pressure problems.

b) Folk uses of Rudraksha

E. ganitrus is commonly known as Rudraksha and is considered as the most sacred and spiritual plant in the Hindu religion [42]. It is believed to be the beloved tree of Lord Shiva as it is originated from the tears from the three eyes of Lord Shiva which represents the sun, moon and fire components according to Hindu mythology. The ancient literature of the *E. ganitrus* plant is briefly described in Shiv Puran, Devi Bhagwat Puran, Padma Puran [43]. This plant is originated in the Tarai region of the Himalayas as per the literature study [44]. According to Hindu mythology Rudraksha is considered as a symbol that links earth and heaven. It contains the secrets of the evolution of the entire cosmos within itself [45]. It is also believed for centuries that wearing of Rudraksha bead helps in attaining physical and mental power to accomplish spiritual enlightenment [46]. Wearing the rosary of Rudraksha beads as an ornament on the neck, wrist, arm and head makes the person fearless and is believed that the person cannot be killed by any living being as per Shiv Purana. Traditionally, Rudraksha beads are classified based on their faces, mukhas, or clefts. About 38 types of Rudraksha are mentioned according to ancient scriptures in which one mukhi and fifteen to twenty mukhi Rudraksha are rare and expensive. Before wearing, Rudraksha beads are worshipped by chanting specific Beej mantra and performing particular rituals and rites. Traditionally, the Rudraksha plant is used to relieve stress, anxiety, lack of concentration, depression, and palpitation. A five Mukhi Rudraksha is used against anxiety and stress disorders which works if the Rudraksha bead is held tightly in the right palm for ten minutes. It will help in reforming their confidence and make their bodies stable. Garbh Gauri Rudraksha bead is considered to have positive effects on the women who faced the problems in conceiving a child and miscarriage. It is also helpful in women facing hysteria and coma. The paste of ten-faced Rudraksha bead helps in curing prolonged cough when taken with milk thrice a day. It also helps in treating ringworms, pimples, boils, sores and other skin diseases. Wearing three-faced Rudraksha bead helps in children suffering from frequent fever. The powdered form of Rudraksha bead when mixed with the same quantity of black peppers helps in getting rid of smallpox disease when taken with water [47]. The four-faced Rudraksha bead when boiled with milk helps in curing mental illness and helps in increasing memory. The plant also has antiaging properties. The fruits of the Rudraksha plant showed excellent results against malaria, control fever and acts as an antipyretic agent [48]. The flesh of fruits is

useful against epilepsy disease [49]. The leaves and bark of the *E. ganitrus* plant are helpful in treating rheumatism and vomiting of blood. Besides this, Rudraksha beads are used in astrology. Table 4 is showing the different types of Rudraksha and its traditional and astrological uses.

c) Modern view:

The Rudraksha plant is considered as the most valuable and important herbal plant in the present scenario. The demand for the Rudraksha plant and its products are also rising with the increasing population. To fulfill the demand of people, artificial manufacturing of Rudraksha plant products has risen to enhance the business. In today's world, rarely faceted Rudraksha beads like Ekk mukhi (one-faced) beads are manufactured artificially to fulfill the public demand and make more money. So, it is important to check the quality and purity of the genuineness of beads. It can be checked by various methods like the copper coin test in which the bead is placed between two copper coins, it will rotate slightly if it will be the genuine one. Because of the presence of electromagnetic properties like resistance, capacitance, inductance, magnetic forces, the original can be checked. The water test can also help in checking the beads like Trijuti and Gauri-Shankara by boiling them in water, discoloration appears in an artificial one. Also, the genuine bead sinks in water but the artificial one prepared from wood impregnated with lead can sink giving fake impressions.

REPORTED THERAPEUTIC AND PHARMACOLOGICAL USES

The reported studies on various *in vitro* and *in vivo* model proves the significance of *E. ganitrus* plant in the medicinal system. It possesses various pharmacological and therapeutic properties as per the reported studies. Some of the reported studies are shown in table no. 5.

Analgesic and Anti-inflammatory: The petroleum ether, chloroform, methanol and aqueous extract isolated from the leaves of the *E. ganitrus* plant was tested against rats using carrageenan-induced paw edema and in mice using tail flicks test. The methanol and aqueous extract of the leaves of *E. ganitrus* plant when given in all doses i.e., 50, 100 and 200 mg/kg showed significant inhibition of edema at the 3rd hour of the treatment. The maximum number of inhibition of edema at the 3rd hour of the treatment was seen in 200mg/kg i.e. 46.21% and 41.66% for both the extracts. The methanol and aqueous extract of the leaves of *E. ganitrus* possesses significant analgesic activity when given in 100 mg/ kg increased significant response in the tail-flick test. It is

concluded that both methanolic and aqueous extract of *E. ganitrus* plant showed great inhibitory effect which leads to the inhibition of prostaglandin synthesis [50]. The chloroform extract of the fruit of *E. ganitrus* showed significant effects in 5-HT induced inflammation whereas ethanol extract inhibits histamine [51].

Another study was conducted using petroleum ether, benzene, chloroform, acetone and ethanol extracts isolated from the dried fruit of the *E. ganitrus* plant at 200mg/kg showed significant anti-inflammatory action against acute and subacute models of rat pretreated time 30-45 min [52]. Except for petroleum ether and ethanol, all the extracts decreased the swim stress immobility in mice indicating its antidepressant activity.

Antioxidant: The ethanolic extract of the leaves of the Rudraksha plant was examined for their antioxidant, reducing power, metal chelating and hydroxyl radical scavenging activities. It was found that the phenolic and flavonoids constituents present in the leaves possess significant antioxidant activity. Also, the ethanolic extract showed only moderate hydroxyl radical scavenging activity while the extract at the dosage of 500 µg/ml showed maximum iron chelating activity. Moreover, a positive correlation between total phenolic content and antioxidant activity was reported [53].

Anti-hypertensive: The aqueous extract isolated from the seed powder of the *E. ganitrus* plant was examined for the hypertensive activity in renal artery of occluded hypertensive rats [54]. Male Wistar rats were pretreated with an aqueous extract of *E. ganitrus* for six weeks. Results showed a significant decrease in the arterial blood pressure when given in the dosage of 25, 50 and 100 mg/kg in male Wistar rat and Swiss albino mice. Antihypertensive activity is due to the action of the rennin angiotensin system [55,56].

Antimicrobial: *In vitro* study was conducted in bacteria and fungi to detect the antimicrobial activity of the aqueous extract isolated from the leaves of the *E. ganitrus* plant. It was found that the aqueous extract inhibits the growth of *Staphylococcus aureus*, *Bacillus cereus*, *E. coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Penicillium sp*, *Aspergillus flavus*, *Candida albicans* and *C. tropicalis*. The extract showed maximum inhibition against *B. cereus*. It was concluded that the *E. ganitrus* leaves can be used to develop antimicrobial compounds [57,58].

Antianxiety: The petroleum ether, chloroform, ethanol and aqueous extracts of *Centaurea behen* and *E. ganitrus* were formed and examined for antianxiety activity in mice by using an elevated plus maize model. The results were correlated with the

standard drug, diazepam. The result showed that the ethanol extract of *C. behen* and chloroform and ethanol extract of the *E. ganitrus* plant increased the time spent and the percentage of the open arm entries in the elevated plus maize model and therefore exhibit antianxiety activity [59].

Antidiabetic: The antidiabetic activity of the *E. ganitrus* plant was tested in rats in a dose-dependent manner. The extract reduced the streptozotocin-induced hyperglycemia in rats but unable to restore the blood glucose level to the baseline value. Acute oral toxicity of the extract was found in Swiss albino mice. In another study, the aqueous extract of the leaves fruits and twigs of the *E. ganitrus* plant possesses alloxan-induced anti-diabetic activity [60,61].

Antifungal: The chloroform and ethanol extract of *E. ganitrus* plant showed significant antifungal property against *Candida albicans*, whereas these extracts showed moderate inhibitory action against *Aspergillus niger* [62].

Antibacterial: The petroleum ether, benzene, chloroform, acetone and ethanol extracts isolated from fruits of *E. ganitrus* plant were tested for the antibacterial property. The bacterial strains named *Staphylococcus aureus*, *Enterococcus faecalis*, *Bacillus subtilis*, *Salmonella typhi*, *Salmonella typhimurium*, *Vibrio cholera*, *Aeromonas hydrophila*, *Shigella sp.* and *Pseudomonas* showed sensitivity towards these extracts [63].

Antidepressant: The water portion of the 90% of the ethanol extract isolated from the fruits of the *E. ganitrus* showed antidepressant activity which was demonstrated by typical behavioral action, potentiating of hexobarbitone hypnosis, morphine analgesia, anticonvulsant and anti-amphetamine effects. Additionally, the extract also acts as a cardio stimulant, depressor, smooth muscle relaxant and hydrocholeretic agent. Due to this activity, the fruit extract of the plant is used in the treatment of epilepsy, hypertension, asthma, mental diseases and liver diseases in the Indigenous medicinal system [64].

Anti-asthmatic: The petroleum ether, benzene, chloroform, acetone and ethanol extract isolated from the *E. sphaericus* fruits were examined to have mast-cell stabilizing activity, justifying the efficacy of *E. ganitrus* against bronchial asthma [65].

TOXICITY:

Various herbal plants are considered as non-toxic. However, it is mandatory to check their toxicity level at different doses before their therapeutic use. From the reported studies it was found that the aqueous extract of the *E. ganitrus* plant showed no toxic

effects at the highest dosage i.e. 5.0 g/kg body weight in Swiss albino mice. Another study was conducted in male Swiss albino mice to check the toxic effects of the methanolic extract isolated from the Rudraksha plant. The model was injected with 4 doses i.e. 100mg, 200mg, 500mg and 1.00 g/kg of methanolic extract. Results showed the mortality rate and general behavior of the mice for 48h [66] where special attention was given for the first 30 min and the first 4 h after the single administration [67,68]. The seeds of the *E. ganitrus* plant showed no toxicity and no mortality rate up to 1g/kg [69]. In another study, it was found that the aqueous extract isolated from the leaves of *E. ganitrus* plant did not show any hemolytic activity against human RBCs up to 1000 µg/ml concentration and is examined as safe for human use [70,71].

CONCLUSION:

The Rudraksha plant is considered as the most important herbal plant and is of great spiritual, astrological and medicinal importance. As per Hindu mythology, people believe that the one who wears Rudraksha beads achieves mental and physical powers. Traditionally, the Rudraksha plant is used to cure anxiety, stress, depression, palpitation, asthma, hypertension, epilepsy, nerve pain, arthritis, migraine and liver disorders. In Ayurveda, the Rudraksha plant is used to treat BP problems, mental disorders, neurological disorders, asthma, diabetes, reproductive disorders, burning disorder (dahshaman), jwar (fever), prameha (diabetes), raktabharsamak (hypertension) and many more. It also possesses anti-aging properties. From the reported studies it is clear that various extracts or phytochemical constituents present in the Rudraksha plant are of great pharmacological importance and carry anticancer, antidiabetic, anti-depressant, anti-asthmatic, anti-inflammatory, analgesic, hypertensive, antifungal, antioxidant and antibacterial properties. The new property of the Rudraksha plant i.e. the electromagnetic property is also found which is very beneficial to the human body as it helps in curing various diseases. The plant has been gathering the attention of not only human beings but the scientists, physicians and sages who are also showing their interest in the Rudraksha plant because of its power and attributes.

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CONFLICT OF INTEREST

None

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