A REVIEW STUDY ON NEUROPROTECTIVE POTENTIAL OF *GUNJA* (*Abrus precatorius* Linn.) IN NEUROLOGICAL DISORDERS

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ABSTRACT

Gunja (Abrus precatorius Linn. Fabaceae) is an important medicinal plant enumerated under the Upavisha Dravya (semi-poisonous drugs) in Ayurveda. Gunja is Tikta-Kashaya (bitter-astringent) in Rasa (taste), Laghu-Ruksha-Tikshna (lightness, roughness, sharpness) in Guna (physical properties), Ushna (hotness) in Virya (potency) and Katu (pungent) in Vipaka (post-digestive). It pacifies Kapha and Vata Dosha in the body. It has been said to be a stimulator of the nervous system. Gunja had been practicing traditionally to treat tetanus, rabies and other neurological disorders. Usually, leaves, roots and seeds have been used for medicinal purposes. Present review study aims to highlight its therapeutic potential of anticonvulsant and antiepileptic activities. Bhava Pakasha indicated it as Bhrama-Mada-vinasani. Oxidative stress is one of the primary factors that contribute to the development of neurological conditions i.e. Alzheimer, Parkinsonism, epilepsy, stroke, brain degenerative disorders, neurotrauma, hypoxia and others. Petroleum ether extract of A. precatorius revealed the presence of phytoconstituents such as alkaloids, carbohydrates, saponins, triterpenoids and flavonoids. Pre-clinical studies suggested that neuroprotective effects in epilepsy. The ethanolic extract obtained from the leaves of A. precatorius possesses analgesic, muscle relaxant, locomotor, anti-epileptic and anti-depressant activities in the different tested experimental animal models.

Keywords: *Ayurveda, Gunja, Abrus precatorius, Neurological disorders, Anticonvulsant activity.*

INTRODUCTION:

In Ayurveda, *Tridoshas* (three living entity of the body) are the basic principles and living biological entity of the body. *Vata, Pitta* and *Kapha* are the physiological as well the pathological basis of the body. *Vata* is considered as a responsible factor for circulation, conduction as well as regulation of metabolic processes[1]. In Ayurveda, neurological disorders are described under eighty types of *Vata-Vyadhi* which are caused by Vitiation of *Vata. Vata prakopa* occurs by the two ways such as *Kshaya janya* and *Aawaran janya* [1]. *Vatik* disorders have some common symptoms such as *Sankocha* (contraction), *Parvanam stambha bheda* (stiffness of joints and pain), *Pralapa* (irrelevant talk and speech), *Pani prishta shiro graha* (stiffness in hands, back and head), *Khanjya*

Pangulya Kubjatva (Lameness of hands and feet, and hunch-back), *Anga sosha* (Atrophy, emaciation of limbs), *Anidra* (insomnia), *Spandanam gatra suptata* (Twitching sensation and numbness in the body), *Shiro nasa akshi jatrunam griva hundanam* (Shrinking of the head, nose, eyes, clavicular region and neck), *Bheda* (Splitting pain), *Toda* (pricking pain), *Aakshepa* (convulsions), *Moha* (unconsciousness), *Aayasa* (excess tiredness) and other signs and symptoms [1]. These symptoms show neurological intervention and lead to neurological ailments. The aggravated *Vata Dosha* produces specific diseases because of the specific nature of the causative factors. Presently we are living in the era of industrialization and urbanization, which indulges in a faulty lifestyle and stressful life. Neurodegenerative diseases are characterized by a gradual onset of progressive symptoms including loss of memory and tremor, difficulty in learning or retaining information, inability to handle complex tasks, impaired spatial orientation and abilities, language deficits and behavioral changes [2]. Oxidative stress is one of the primary factors that contribute to the development of neurological conditions i.e. Alzheimer, Parkinsonism, epilepsy, stroke, brain damage, hypoxia and others. In Ayurvedic line of treatment of neurological diseases, there is a prescription of a *Visha Dravya. Visha Dravyas* have *Tikshna* and *Vyavyayi Guna,* which instantly distributed in the body and stimulate the *Vatavaha Srotas*. *Gunja* (*Abrus precatorius* Linn.), is an important medicinal plant and enumerated under the *Upavisha* (semi-poisonous drugs) in Ayurveda. *Gunja* has been practicing traditionally in many preparations to treat tetanus, rabies and other neurological disorders. *Gunjabhadra Rasa* and *Mahalaxminarayana Taila* have been extensively used in the treatment of *Vata Vyadhi*.

LITERATURE REVIEW OF *GUNJA*:

Table 1: Indications of Gunja in Ayurvedic texts in *Vata Vyadhi* (neurological disorders)

Formulations/ forms	Indications	References [3-7]
Sharengeshthadi Churna	*Urustambha* (spasticity in the thigh)	CS.Ci 27/33
Avabahukadi Lepa	*Avbahuka* (ulnar neuritis), *visvachi* (radial neuritis), *gridhrasi* (sciatica)	Sa.S.U. 11.101-102
Gunjabhadra Rasa	*Urustambha*	RT.24/467-470, BR.Urustambha.Ci.28/19-21
Raj Nighantu	*Vatahara, Shool har* (pain killer)	R.Ni. Gud.115
Gunjaphala Lepa	*Visvachi, gridhrasi, Vata Vyadhi*	YR. Vatavyadhichikitsa.1-2
Sirahshoolahar Lepa	*Sirah shool* (anti-headache)	BR. Shirorogadhikara.64
Gunja Tailam	*Shiroroga, ardhsirah, bhru, sankh shool* (migraine)	BR. Shirorogadhikara.64
Mahalakshminarayana Tailam	*Vatavyadhihara* (pacifying neurological disorders)	YR. Vatavyadhi.1-5.

GUNJA (*Abrus precatorius* Linn. *Fabaceae*):

Botanical Description:

Gunja is Perennial climber; branches slender, glabrous or sparsely silky, flowering throughout the year; Flower- terminal and/or axillary pseudo racemes, clustered around the swollen nodes of rachis; Calyx 2.5 mm long, glabrous or sparsely silky, Corolla- pink or white with a pink tinge.

Fruit-an oblong pod, thinly septate, pilose, wrinkled, fruiting throughout the year; Seeds- up to 3-5, subglobose, ovoid, 7-8 mm long, scarlet with a black spot at the hilum, sometimes white with a black spot or uniformly black or white. Leaves- 5-10cm long, Petiole- 0.6-1.2 cm long; Leaf arrangement-alternate-spiral; Leaf type-paripinnate; Leaf shape-oblong; Leaf apex-obtuse; Leaf base-obtuse; Leaf margin-entire. Leaflets 10-20 pairs, opposite, petiolule less than 1 mm, lamina 0.8-2.2 cm long, 3.5-6 cm broad, oblong, tip rounded, apiculate, glabrous above, sparsely hairy below [8].

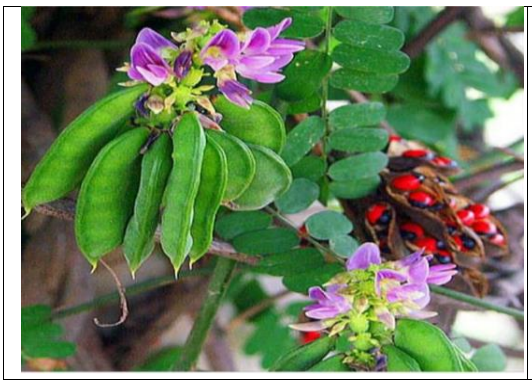

Fig.1: Pods of *Gunja*

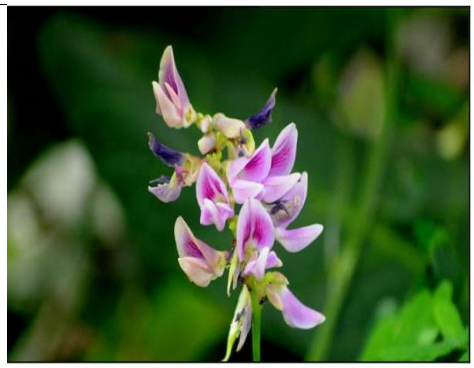

Fig.2: Inflorescence of *Gunja*

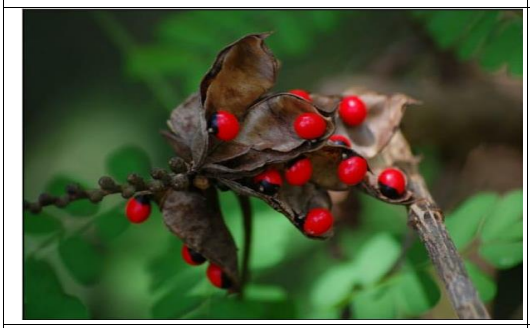

Fig.3: Seeds of *Gunja*

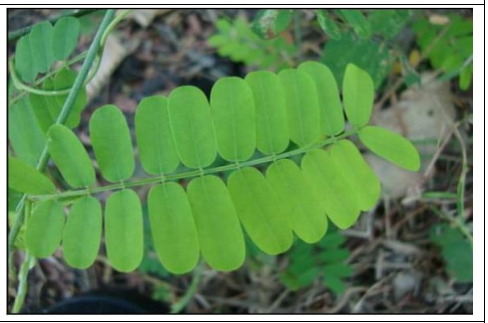

Fig.4: Leaves of *Gunja*

Classical pharmacology [9]:

Rasa- Tikta and *Kashaya*

Guna- Laghu, Ruksha and *Tikshna,*

Virya- Ushna

Vipak- Katu

Dosha Karma- Kapha and *Vatahar*

Phytochemistry:

The plant contains several secondary metabolites such as alkaloids, steroids, flavonoids, triterpenoids, isoflavanoquinones, anthocyanins, starch, tannin, protein, phenolic compound, fixed oil and amino acids [10-11].

Leaves- Leaves contains trigonelline, abruslactone-A, hemiphloin, abrusoside-A, abrusoside-B, abrusoside-C, abrusoside-D, arabinose, galactose, xylose, choline, hypaphorine, precatorine, glycyrrhizin, montanyl alcohol, inositol, D-monomethyl ether and pinitol [12-14].

Roots- Roots contains protein, polysaccharide arabinose, galactose, xylose, triterpenoids, saponins, glycyrrhizin, oleanolic acid, isoflavonoids, quinones-abruquinones A, B, C, D, E, F, abrol, abrasine, precasine, precol, abraline, abricin, abrusgenic-acid, abruslactone, abrussic-acid, anthocyanins, calcium, campesterol, cycloartenol, delphinidin, gallic-acid, trigonelline, hypaphorine, choline, pectin, pentosans, phosphorus, delphinidin, gallic-acid, picatorine, polygalacturonic-acids and precatorine are present in the root [15-18].

Seeds- Seeds contains alkaloids, flavonoids, triterpenoids, steroids, saponins, flavones, flavonol glycosides and reducing sugars. Seeds are rich in several essential amino acids like serine, abrusin, abrusin-2′-0-apioside, hederagenin, kaikasaponin III, sophoradiol, sophoradiol-22-0-acetate, tryptophan, trimethyl, alanine, amyrin, alpha, ursolic acid, valine and methyl ester. It contains poisonous fat-splitting enzyme, aglucoside, abrussic acid, haemagglutinin, abrin A, abrin B, abrin C, abrin l, abrin ll, abrin lll, abrus agglutinin APA-l, Abrus agglutinin APA-ll, abrus-saponins I and II, abrisapogenol, β-amyrin, arachidyl alcohol, brassicasterol, decan-1-ol docos-13-enoic acid, lectin, anthocyanins-abrectorin, dimethoxycentaureidin-7-0-rutinoside, precatorins I, II, III, abrectorin, centaureidin, demethoxy 7-O-beta-drutinoside, luteolin, precatorine and orientin [18-22].

Modern pharmacology:

The plant having anti-diabetic, anti-oxidative, neuroprotective, anti-viral, neuromuscular, anti-convulsant, anti-epileptic, immune-modulating, abortifacient, anti-implantation, anti-helminthic, anti-depression, memory enhancing, anti-serotonin, diuretic, anti-microbial, anti-inflammatory, anti-arthritic and analgesic, anti-cancer, anti fertility, anti-spermatogenic, anti estrogenic, anti-malarial, anti-allergic, anti-asthmatics, anti-cataract, anti-insecticide, anti-toxic activity [23-24].

Neuroprotective effect:

Petroleum ether extract of aerial parts of *A. precatorius* at different concentration (100 mg/kg and 200 mg/kg) in hypoxic neurotoxicity induced rats, was carried to evaluate neuroprotective effects. The study showed significantly promoted spatial behavior at tested doses as compared with hypoxic rats. Oral administration of the extract restored the decreased levels of enzymes such as glutamate, dopamine and acetylcholinesterases. It showed the neuroprotective effects when given orally [25-26].

Anti-convulsant/Antiepileptic activity:

Ethanol (70%) extract of the fresh root of *A. precatorius* administered intraperitoneally to metrazole induced convulsions in mice of both sexes at different dosage levels was significantly active but results were opposite when tested in strychnine-induced convulsions [27]. A study was also carried on Ethanol/water (1:1) extract of the aerial parts of *A. precatorius,* showed no statistically significant difference at a dose of 500 mg/kg in electroshock-induced convulsions [28]. A cross-sectional study was performed on *A. precatorius* leaves boiled with water and given orally in the

amount of three table spoonfuls twice daily dosage regimen for epilepsy and proved its significant antiepileptic activity [27].

Neuromuscular effects:

Crude extracts from the leaves of *A. precatorius* were investigated on different isolated tissue like rectus abdominis, rat phrenic nerve-diaphragm muscle and isolated tissue of young chicks. The extract inhibited acetylcholine-induced contractions on rectus abdominis and rat phrenic nerve-diaphragm muscle preparations. The study showed effects were concentration-dependent and reversible. The extract also caused flaccid paralysis when injected intravenously into young chicks. The ethanol extract had no effect on direct electrical stimulation of rat diaphragm. The inhibitory effect of the ethanol extract on the rat phrenic nerve-diaphragm preparation was potentiated in the presence of reduced calcium ions, elevated magnesium ions, or reduced potassium ions. Thus, the extract showed a similarity to d-tubocurarine with respect to the pattern of neuromuscular blockade [29].

Anti-depressant activity:

Administration of ethanol (70%) extracts of the fresh root of *A. precatorius* in mice of both sexes at variable dosage levels, showed anti-depressant activity [30].

Neuromuscular blocking activity:

Ethanol (95%) extract of dried leaves of *A.precatorius* was administered at a concentration of 0.5µg/ml and showed blocking action on phrenic nerve-diaphragm [29].

Anti-Alzheimer's disease and memory enhancer activity:

A study was designed to evaluate the glycol-histochemically microglial cells (MGC) activation in autoptic brain samples of Alzheimer's disease model. *A.precatorius* agglutinin lectin recognizes MGC in the cerebral white matter Alzheimer's patients. These MGC are of rod-like types and appear to be particularly dense in those areas proximal to an oligodendroglial cell. The identification of new markers for the study of MGC is very important to better understand the role of these types of cells in the metabolic/ dysmetabolic control of βA4 (amyloid protein) in Alzheimer's patients [31].

Anti-oxidant activity:

In *in-vitro* study ethanol extract of *A. precatorius* seed was evaluated to determine antioxidant activity. A total phenolic compound in ethanol seeds extract of *A. precatorius* was found to be 95 mg/g of extract calculated as gallic acid and total flavonoids compound was found to be 21 mg/g of extract calculated as rutin. Ethanol extract of *A. precatorius* seeds possesses potent antioxidant activity in different enzymes levels when compared with reference compound butylated hydroxytoluene (BHT) [32].

Precaution:

Gunja seed has potent toxic compound *Abrin*, which can be expelled by removal of seed coat as well as by purification by boiling. Unpurified seeds and roots and if used in excess dosage than prescribed, produce toxic effects such as severe vomiting and diarrhea. *Gunja* containing any medicines are avoiding during pregnancy, lactation and children below five years of age [33]. It is classified under Drugs and Cosmetics act-schedule E-1 Rule 161(2) classified herb and it has to taken under strict medical supervision [34].

DISCUSSION:

Gunja has been used traditionally in neurological disorders such as tetanus, rabies and other nerve degenerative conditions. It ameliorates cognitive deficits impaired by sodium nitrite water and thus activates neuroprotection from sodium nitrite-induced hypoxia. Hypoxia in the brain increased the AChE (acetylcholinesterases) activity and brain glutamate which lead to degeneration of brain cells. Petroleum ether extract induces a significant reduction in enzyme levels and protects from neurodegeneration. The extract of G*unja* also significantly increased the reduced dopamine level in Alzheimer's. Ayurvedic perspective *Ushna, Tikshna,* properties of *Gunja* induces stimulation of nerve induction and pacifies covering of *Kapha* upon the *Vata* by *Pachana karma.*

CONCLUSION:

Neurodegenerative diseases are characterized by a gradual onset of progressive symptoms including loss of memory and tremor, difficulty in learning or retaining information, inability to handle complex tasks, impaired spatial orientation and abilities, language deficits and behavioral changes. All the review study on pharmacological activity related to neurological functions reveals that *Gunja* (*Abrus precatorious*) have potent neuroprotective potential. Authors have suggested that there is further need for a pre-clinical and clinical study on the specialized animal model to achieve maximum benefits and removes any toxic effects.

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