



BRAHMI (BACOPA MONNERI) : AN AYURVEDIC MEDICINAL HERB AND BRAIN TONIC

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Abstract :

Brahmi scientific name is *Bacopa monnieri*, *Herpestis monniera*, water hyssop. In Ayurvedic medicine, it is one of the most popular neurotonic belonging to the family Scrophulariaceae. *Bacopa monnieri* is commonly known as “Brahmi” in Sanskrit. Brahmi is a medicinal plant used as memory booster and enhance brain function. It is used to treat anxiety, anger, insomnia, nerve pain, emotional problems, and learning problems. It is also used as a cardi tonic, digestive aid and respiratory enhancer. It has antioxidant, anti-aging, anti-depressant, anti-cancer and anti-bacterial activity. It has been used to treat epilepsy and asthma. This review provides a brief overview of the pharmacognostic description, therapeutic value, marketed formulations and other physiological effects of *Bacopa monnieri* such as anti-inflammatory, cardi tonic and other medical effects. This review focuses on various specimens of *Bacopa monnieri*. Let's briefly consider the importance of Brahmi (*Bacopa monnieri*).

Keywords : *Bacopa monnieri*, Brahmi, Chemical Constituents, Bacopaside, Memory Enhancer, Nootropic, Antioxidant, Antiparkinsons,

Introduction:

Bacopa monnieri (BM) is a glabrous, creeping, small succulent herb belongs to the family Scrophulariaceae. *Bacopa monnieri* is a highly effective brain tonic, it grows naturally in wet soil, shallow water and marshes and is easily cultivated where adequate water is available. It is a plant that is native to both India and Australia. *Bacopa*'s botanical name has numerous synonyms, commonly encountered ones include: *Bacopa monniera* Wettst., *Bacopa monniera* Linn, and *Herpestis monniera*. *Bacopa* is known as *medhya rasayana*, due to its ability to improve the cognitive properties of brain and is a very commonly used herb all Ayurvedic practitioners to treat conditions such as fever, inflammation, pain, asthma, epilepsy, insanity, and memory loss. It is useful in epilepsy, dementia, ulcer, constipation, asthma, sterility, and general debility. It helps to regain general mental health.

Synonym : water hyssop, brahmi, thyme-leafed gratiola, herb of grace, and Indian pennywort.

Biological source : It is a small perennial herbaceous plant commonly known as ‘Brahmi’, belonging to the family Scrophulariaceae.

Phytochemicals – These are mannitol, sterols, alkaloids, saponin, brahmin and herpestine.

Taxonomical classification of *B. monnieri*

- Kingdom: Plantae.
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- Division: Magnoliophyta.
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- Class: Dicotyledonae.
-
- Subclass: Gamopetalae.
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- Family: Scrophulariaceae.
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- Genus: *Bacopa*.
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- Specie: *Monnieri*.

Morphological study :



fig.no.1

The plant is succulent when it is young but shrivels up as it dries; it has a mildly bitter flavor but no distinctive smell, and it is made up of broken, matted-up pieces of roots, branching stems, leaves, flowers, and a few tender fruits .

Root:

Dried main root fragments have a cylindrical shape, a diameter of about 5 mm, are longitudinally wrinkled, and are off-white in color.

Stem:

the stem are cylindrical, glabrous, with prominent nodes, at times attached to vertically growing branches, and ventrally to a cluster of tortuous, brittle roots. Internodes are about 1–15 cm long, 3–4 mm wide, and are a light yellowish green color with a purplish tinge.

Leaf :

Simple, opposite, decussate, glabrous, oblong type, 0.6-2.5 cm in length and 3-8 mm in width, Entire, lower surface speckled with tiny specks, obscurely 1-3 nerved, color faint green .

Flower:

Nearly regular, solitary, pale blue or pinkish-white, axillary. 0.6-3 cm in length, typically longer than the leaves, with two linear bracteoles, a slender pedicel, glabrous calyx, and a deeply 5-partite corolla. Additionally, it has four didynamous stamens, two-celled anthers, a syncarpous pistil, two chambers with numerous ovules, and a style with a bilobed stigma.

Fruit:

Fresh persistent calyxes are 1-3 cm long, glabrous, and globose to ovoid in shape. They are enclosed within a 5 mm long capsule. Numerous, minuscule, oblong or irregular seeds that are less than 1 cm wide.

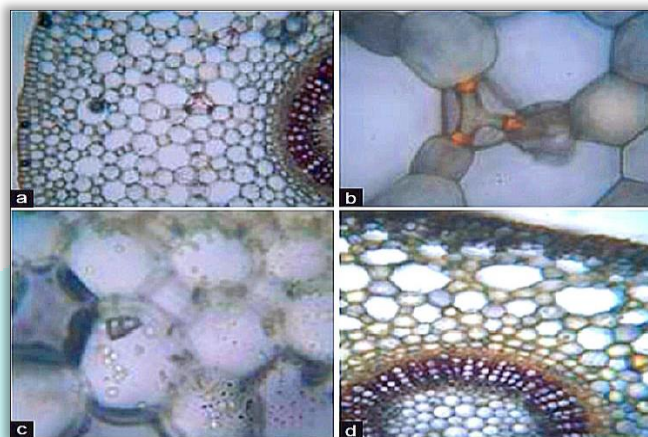
Anatomy of Bacopa monneri :

fig.no.2 T.S. of brahmi stem

The outer epidermis, cortex, and endodermis could be seen in the transverse section of the stem. Parenchymatous Cells with Chlorophyll and Tannin-Containing Cells make up the first two to three layers of the hypodermis. Aerenchyma, which makes up two thirds of the section, is modified and created by cortical cells. Tannin-containing cells are located on the side that connects two adjacent cells, giving it a Y-like appearance. There is only one layer of endodermis. The vascular system is radial in nature. Xylem is widespread. Protoxylem is located toward the pith, while metaxylem is situated toward the pericycle. Large pith is present in the center. T.S. section of leaf show outer layer epidermis. Below the epidermis, there are three to five layers of palisade. Chlorenchymatous tissue is composed of palisade and spongy cells. The midrib portion consists of a vascular bundle. Midrib and lamina contain calcium oxalate crystals. stomata are of two types Diacytic and anisocytic. In 1959, Raghavan noted that the Plant chromosome number was $2n=64$.

Chemical constituents :**Major**

Saponins, alkaloids, brahmine, and herpestine are the main constituents of bacoside A. The sapiens known as bacoside A, bacoside B, and betulic acid. D-mannitol, stigmasterol, -sitosterol, and stigma sterol have all been isolated. Bacoside A on acid hydrolysis yielded three sugars, of which glucose and arabinose were two of them. Bacoside B on hydrolysis yield glucose and arabinose .

Others

include Bacoside B, Bacoside A1, Bacoside A3, Bacogenin A1, Bacogenin A2, Bacogenin A3, Bacogenin A4, Bacopa Saponin-C, Bacopasides I and II, Bacopasides III-V, Bacobitacins A-D, Monnieraside I, Monnieraside III, Monneri, and Plantioside B; . betulic acid, wogonin, o Luteolin, luteolin-7-glucoside, stigmasterol, Stigmasterol, β -sitosterol, D-mannitol.

Ethnopharmacology:

It is bitter, astringent, and has cooling properties in addition to being said to sharpen the mind. It is widely used for The treatment of asthma, hoarseness, dermatitis, anemia, diabetes, cardiac disorders, insanity, and epilepsy .Whole plant is used for medicinal purposes, such as leaf juice given to children for relief from

bronchitis and diarrhea, leaf paste used to treat rheumatism, and leaf decoction used to treat cough disorders. Additionally, it has been noted that when combined with ginger juice, sugar, and extracts from the bark of the *Moringa oleifera* plant, it is a safe cardiac tonic and relieves anxiety neurosis in patients. It was claimed to be a strong antioxidant and blood vessel dilator.

Pharmacological Activity :

Memory Enhancer:

Brahmi's antioxidant property might be helpful in preventing age-related memory loss. Free radical damage may be lessened, and enhance learning ability. Additionally, brahmi may be helpful in lowering the accumulation of a protein linked to Alzheimer's disease. When taken regularly, brahmi helps in managing age-related memory loss. According to Ayurveda, Vata regulates the nervous system. Weak memory or decreased mental activity are symptoms of a Vata imbalance. Brahmi helps to improve memory and provides immediate mental alertness. This is as a result of its Medhya (improve intelligence) and Vata balancing qualities.

Anti-anxiety :

The anxiolytic (anti-anxiety) property of brahmi makes it potentially helpful in managing anxiety. It may lessen the signs of anxiety and mental fatigue. In addition, neuroinflammation, which is the cause of anxiety, may be prevented by Brahmi. Neuroinflammation is an inflammation of the nervous system. Brahmi is effective in treating the signs and symptoms of anxiety. According to Ayurveda, Vata regulates the nervous system. Vata imbalance is the primary cause of anxiety. Vata is balanced by Brahmi, and gives a calming effect on the nervous system.

Antiepileptic :

Brahmi is full of antioxidants that shield the brain cells. Certain genes and their associated proteins production and activity gets reduced when an epileptic attack occurs. Brahmi stimulates these genes, proteins and pathways and reversed the cause and effects of epilepsy. Brahmi helps in the management of epilepsy symptoms. Apasmara is the Ayurvedic term for epilepsy. Seizures can occur in epileptic patients at various times. Uncontrollable and swift body movements are a result of abnormal electrical activity in the brain during a seizure. All the three doshas Pitta, Kapha, and Vata are involved in epilepsy. Brahmi reduced seizure episodes while balancing all three doshas. Because of Medhya (improve intelligence) property of Brahmi it also helps in maintaining healthy brain function.

Anti-asthmatic :

Because of antiasthmatic properties, Brahmi may be helpful in managing asthma. It soothes the respiratory system and aids in the treatment of allergic reactions. Brahmi helps in reducing the signs and symptoms of asthma. According to Ayurveda, the main doshas involved in asthma are Vata and Kapha. In the lungs, the congealed "Kapha dosha" and vitiated "Vata" combine to obstruct the respiratory passage. This results in difficulty in the breath. This condition is known as Saws Roga or Asthma. Brahmi helps to calm Vata-Kapha and removes excess mucus from the lungs. This gives relief from the symptoms of as

Anti-Parkinson's :

Parkinson's disease (PD) is a slowly progressing, degenerative condition marked by the loss of nerve cells in the substantia nigra area and the accumulation of a crucial protein, alpha-synuclein, in the striatum and surrounding areas of the brain. The antioxidant and Neuroprotective effects of *B. monnieri* confer anti-Parkinsonian activity of the plant that is associated With lower alpha - synuclein protein aggregation and the Selective death of dopaminergic neurons.

Anti – Alzheimer's :

AD is a serious and expanding issue for public health. Amyloid-peptide accumulation in senile plaques and abnormally phosphorylated tau proteins are its defining features. It is linked to cognitive impairment and dementia. It has been established that tau protein hyperphosphorylation is the underlying cause of a class of neurodegenerative diseases known collectively as "tauopathies.". The unfavorable result is a reduction in the protein's affinity for microtubules, an increase in the production of fibrillary aggregates, and an accumulation

of insoluble neurofibrillary tangles. Bacopa has been demonstrated to reduce beta-amyloid buildup in the brain in AD animal models. This plant had a noticeable impact on memory improvement. This herb helps with learning, holding onto it, and recovering, according to research. Numerous herbs are effective against AD, according to the evidence. Of all the herbs, only brahmi and its active ingredient have been studied for treating AD. Recently, it was revealed that an alcoholic extract of *B. Monnieri* facilitates the decline in neurons and cholinergic neuron densities in a rat model of AD and significantly reduces escape latency time in the Morris water maze test. A thorough description of *B.*'s mechanism of action.

Anti-cancer activity :

Glioblastoma One of the most common brain tumors is glioblastoma multiforme (GBM), which is very aggressive and has a poor prognosis, including intermediate survival. Generally, this problem is documented by the occurrence of abnormalities in genes involved in the Notch signaling pathway ; these abnormalities appear to play an important role in the full control and self-healing of cells, among other things. Genetic abnormalities.. neural stem cells . Treatment options for GBM include surgery followed by radiation therapy and chemotherapy with temozolomide. In recent research on the advancement of cancer treatment, bacoside a has received great attention for its anti-cancer potential in GBM cells. Bacoside has been defined as the jujubogeninisomer of bacoside a3, bacopacid ii, bacopasaponins c and Bacopasaponin c .

Extraction of *B. monnieri* :

Bacopa monnieri extract (1) is prepared by the traditional maceration method are as follows :

- Dissolve Bacopa monnieri (1) dried plant powder in methanol, ethanol and water.
- Keep each mixture separate for 72 hours.
- Shake occasionally at room temperature.
- After the maceration is completed, the supernatant is decanted and the mixture is filtered.
- The extract was concentrated to dryness and the filtrate was kept until the solvent was completely evaporated.
- After evaporation of the solvent, the extracts were weighed and stored in glass containers for determination of phytochemical composition and antimicrobial activity.

The aqueous extract was reconstituted in sterile distilled water to the concentration required for antibacterial activity. Prepare the extract of the desired concentration by dissolving the methanol extraction powder in anhydrous methanol. Four solutions of 1.25mg/ml, 2.5mg/ml, 5mg/ml and 10mg/ml were prepared and used for antibiotic use.

Physicochemical analysis :

Determination of extractive value :

The extractive value in percentage were calculated by using following formula.

$$\text{Extraction value (\%)} = \frac{\text{weight of dried extract}}{\text{Weight of plant material}} \times 100$$

Determination of ash value :

➤ Total ash :

First, take 2 g of dry plant material of *Bacopa monnieri* and ignite it slowly by heating to 500-600°C until it turns white. It is cooled in a desiccator and weighed. Calculate the total ash content expressed as a percentage.

➤ **Acid Insoluble Ash :**

The residue obtained by boiling the total ash with dilute hydrochloric acid and igniting the remaining insoluble material.

- Add 25 ml of dilute HCl to the crucible containing total ash and boil gently for 5 minutes.
- Collect the insoluble material on filter paper, wash with hot water.
- Then burn the filter paper, cool in a desiccator and measure.
- Calculate the acid-insoluble ash content expressed as a percentage.

➤ **Water-soluble ash value :**

Boil the total ash with 25 ml of water for 5 minutes, the soluble matter collected in a crucible, ignite and weigh. Calculate the water-soluble ash content expressed as a percentage.

Loss on drying :

Loss on drying is the percentage of weight loss. Loss on drying determines the amount of moisture and impurities in the API. Moisture is a significant component of harmful chemicals and needs to be removed as much as possible.

- Place approximately 2 g of Bacopa monnieri powder in a glass Petri dish.
- Place the trays in a vacuum oven, turn on, and dry at 100 to 105°C for 2 hours until a constant weight is recorded.
- It is then cooled to room temperature in a desiccator, weighed and recorded.

Calculate the percentage (%) of weight loss on dryness using the following formula.

$$\text{Loss in drying (\%)} = \frac{\text{Loss in weight of the sample}}{\text{Weight of the sample}} \times 100$$

Phytochemical screening of Methanolic, ethanolic, aqueous extracts of Brahmi :

Different phytochemical tests were performed to determine the phytochemical profile of plant extracts. Phytochemical analysis of Bacopa monnieri (L) for carbohydrates, proteins, amino acids, steroids, glycosides, cardiac glycosides, anthraquinone glycosides, saponins, flavonoids, alkaloids and tannins. Extracts obtained from methanol, ethanol and aqueous solutions were used for phytochemical analyse.

Table.no.1 phytochemical screening of extracts of brahmi

Phytochemical test	Reagent used	Observation	Result
Alkaloid test	1) Mayer's reagent 2) Wagner's reagent 3) Hager's reagent	<ul style="list-style-type: none"> • Appearance of white creamy precipitate. • Formation of reddish brown precipitate. • Formation of yellow precipitate. 	Positive test
Glycoside test	1) legal's reagent 2) Borntrager's reagent	<ul style="list-style-type: none"> • Appearance of pink / red colour. • No formation of pink red colour 	Positive test Negative test
Carbohydrate test	Molisch's reagent	Formation of violet ring	Positive test
Protein test	Millon's reagent	Formation of White precipitate	Positive test
Amino acid test	Ninhydrin reagent	Formation of Purple colour	Positive test
Tannin test	Nitric acid test	Formation of reddish yellow colour	Positive test
flavonoid test	Sodium hydroxide test	Decolorization occurs	Positive test
Steroid test	Liebermann burchard reaction	Appearance of blue green colour	Positive test

Ayurvedic formulations of Brahmi :

Brahmi capsule :

Brahmi capsules are an extract of the Brahmi plant (*Bacopa monnieri*) and contain only natural, pure, organic ingredients packed with properties and health benefits. Brahmi Ayurvedic medicine can be used to treat a variety of problems in the nervous system, as well as reduce stress, anxiety, and sleep.

Dosage : Take 1-2 capsule twice a day after meals with milk or water.



fig.no.3 brahmi capsule

Brahmi Oil :

Brahmi oil is good for hair as it reduces hair loss. It also strengthens hair follicles and promotes new hair growth. It prevents premature graying of hair and reduces dandruff. Apart from being good for your hair, this oil is also known as a natural sleep aid, stress reliever and stress reliever. It also helps heal mouth ulcers and relieve joint pain. Lastly, Brahmi oil also aids digestion and keeps the skin healthy and glowing. It is used to massage joints and relieve arthritis and pain.



fig.no.4 brahmi oil

Brahmi juice :

Brahmi juice is best known for its ability to improve memory, it can also reduce anxiety and sleep, improve intelligence, and help increase concentration and alertness.

Ingredients : Stems and leaves of Brahmi, a few pudina or mint leaves (optional), 2 teaspoons lemon juice (optional), 1 and ½ teaspoons honey (optional), 3 glasses of water.

Method of preparation :

Blend brahmi with mint or pudina in a grinder. Add a glass of water and grind. Now pour the mixture into the pot and boil over medium heat until it bubbles. Turn off the heat and wait until it reaches room temperature. Now add optional lemon juice and optional honey. Then add two more glasses of water and offer it.

Brahmi juice is used as a nutritional supplement. It provides nutrients to neurons and improves learning. It increases learning ability and acuity. Brahmi's ability to improve memory is due to the alkaloids it contains, such as bacopasides.

Direction of use : Take 30 ml or 60 ml before meals once a day directly or dilute with water.

Brahmi powder :

Brahmi powder is an concentrated form of the Brahmi plant known for its ability to improve cognitive health. The powder is obtained by carefully drying and crushing the leaves. Brahmi Powder (Bacopa Monnieri) has antioxidant and anti-inflammatory properties. It is rich in vitamins and minerals that support brain functions and mental clarity. One Ayurvedic Brahmi Powder is used to treat the brain and nervous system and strengthen the entire nervous system. Brahmi powder acts as Rasayana and effectively improves the body's nutrition. The chemical properties of Brahmi calm the mind, improve brain functions, reduce stress, anxiety and depression, and promote good sleep. It is often used as a memory enhancer, including long/short

memory and retention. Due to its antioxidant properties, it rejuvenates the scalp and supports natural hair growth.



fig.no.5 brahmi powder

Summary :

Bacopa monnieri is a small perennial plant native to India and other tropical regions. All parts of the plant are used for medicinal purposes. Morphological study of brahmi (*Bacopa monnieri* Linn.) helps in identification of wetland plants. Phytochemical studies have shown the presence of fatty acids, alkaloids (e.g. brahmine), antioxidants (e.g. apigenin, rutin, myricetin) and terpenoids (e.g. marcoside derivatives). Phytochemical analysis helps to identify bioactive phytochemicals of *Bacopa monnieri* and from physicochemical analysis it was observed that *Bacopa monnieri* has less loss on drying. The extraction method of *Bacopa monnieri* was investigated. These studies have developed Ayurvedic formulations for the treatment of various ailments such as anxiety, depression, epilepsy, anti-Parkinson, anti-Alzheimer, asthma, bronchitis, heart problems, hyperthyroidism, Stomach ache and sometimes cancer. Brahmi can increase Dhee (power of attainment) and Smruti (power of consciousness) by its Ushna Virya property. Therefore, we can prove that Brahmi (*Bacopa monnieri* Linn.) has the feature of being a plant that is good for many diseases. *Bacopa monnieri* therefore has broad prospects.

Conclusion :

From this study, it can be concluded that the *B. monnieri* plant shows the ability to treat many diseases. *Bacopa monnieri* is considered an important herb used in the preparation of various Ayurvedic and folk medicines. It shows good potential in the development of different neuropharmacological diseases, exacerbations and other problems. B. Methanol and ethanol extraction *Monnieri* is used as an important part of medicine in the treatment of many ailments. Moreover, Bacoside A is considered the most important phytochemical derived from this plant and can be used in the preparation of many medicinal products. Brahmi is known to have anti-inflammatory, anti-diabetic, palliative, antibiotic, antioxidant and memory enhancing properties. *Bacopa monnieri* appears to be a valuable medicinal product.

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