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Phyto-pharmacological review of *Bacopa monnieri* Linn.

Mrinmay Das*, Bhupendra Shrestha, Supriya Datta, Sujit Das, Jyotirmay Deb

Department of Pharmaceutical Chemistry, Himalayan Pharmacy Institute, Majhitar, East Sikkim - 737 136, (INDIA)

E-mail: mrin_hpc@rediffmail.com

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ABSTRACT

Bacopa monnieri Linn. (Family: Scrophulariaceae), known as “Brahmi,” has been used in the Ayurvedic system of medicine for centuries. Traditionally, it was used as a brain tonic to enhance memory development, learning and concentration^[1] and to provide relief to patients with anxiety or epileptic disorders^[2]. The plant is also used as cardio-tonic, digestive aid, hepatoprotective and to improve respiratory function in cases of bronchoconstriction^[3]. *Bacopa*'s antioxidant properties may offer protection from free radical damage in cardiovascular disease. In this review, we have explored the Phyto-pharmacological properties of the *B. monnieri* plant and compiled its vast pharmacological applications to comprehend and synthesize the subject of its potential image of multipurpose medicinal agents. © 2010 Trade Science Inc. - INDIA

KEYWORDS

Bacopa monnieri;
Saponins;
Medicinal plant;
Hepatoprotective;
Antioxidant.

INTRODUCTION

From time immemorial man has been in search for plant, animal and other materials that can be used to take care of the pains, deformities ailments and diseases that inflict some of the unfortunate member of our society. Although modern medicine or allopathic has been accepted by a large portion of the population of the world, only in recent years has there been a new look at natural remedies, home remedies and simple ways of using plant material which are so easily available in one's own backyard or in the neighborhood^[4].

The World Health Organization (WHO) estimates that about 80% of people living in developing countries rely almost exclusively on traditional medicines for their primary health care needs. Since the medicinal plants are backbone of the traditional medicine, this means that, 33,000 million people in the under developed

countries where there has been a great fascination for the herbal medicines and dietary food supplement in the last decade^[5].

Herbs have been used to promote good health since ancient times. Herbal remedies use the whole plants: powdered so they can be swallowed, drunk as a tincture, decoction or infusion, or mixed with an oil-based carrier to form an ointment. In general herbal medicines have a gentle action and may take a number of weeks to achieve their effect. With herbal medicines the overall effect is usually due to a combination of natural constituents which modify each other's action^[6].

Bacopa monnieri Linn., a member of the Scrophulariaceae family, is a small, creeping herb with numerous branches, small oblong leaves and light purple flowers. *Bacopa monnieri* Linn. traditionally known as Brahmi, is an important “Medhya” (Brain Tonic) in Ayurveda for improvement of intelligence, memory &

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Fruits



The whole plant



Flowers and leaves



revitalization of sense organs. It is also capable of imparting youthful vitality and longevity. The drug is reported to be used in cold, sweat, cooling, laxative, intellect promoting, carminative, digestive, anti-inflammatory, anticonvulsant, cardiotoxic, bronchodialator and tonic. It is useful in epilepsy, amentia, ulcer, constipation, asthma, sterility, fever and general debility. It helps to regain general mental health through its rejuvenative effect^[7-9].

In India and the tropics *B. monnieri* grows naturally in wet soil, shallow water and marshes. The herb can be found at elevations from sea level to altitudes of 4,400 feet and is easily cultivated adequate water is available. The entire plant is mainly used. The following figures show various parts of the plant *B.monnieri*^[3].

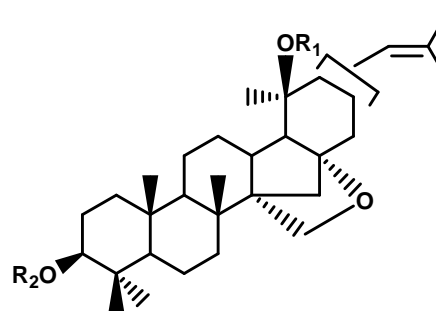
Phytoconstituents from *Bacopa monnieri*

Compounds responsible for the pharmacological effects of Bacopa include Alkaloids, Saponins and Sterols. Many active constituents-the alkaloids, Brahmine and Herpestine, saponins, d-manitol and hersaponin, acid A and monnierin-were isolated before. Other active constituents have been identified as numerous bacosides and bacopasaponins^[10-14].

The aerial parts of the plant contain a large no of Saponin, Alkaloids and also Sterols. But the chief constituents of *Bacopa monnieri* are tetracyclic triterpenoid saponins, Bacoside A & B. Among these, Bacoside A is predominant. Bacoside A & B have identical saponogenin and also have the same sugar moiety but Bacoside A & B differs only in optical rotation. On acid hydrolysis Bacoside A & B yield glucose, arabinose and bacogenin A1, A2, A3 and A4. A1 and A2 are the epimers. Bacogenin A4 is the major components. The other minor compounds includes Saponins viz., bacoside A1 and A3, hersaponin, monnierin; Alkaloids viz., herpestine and brahmine; Flavonoids viz., luteolin-7-

glucoside, glucuronyl-7-apigenin and glucuronyl-7-luteolin; Phytosterols viz., stigmasterol, betasitosterol etc.^[15-21].

Active principle



No.	Components	R ₁	R ₂
1.	Bacoside A1	H	α -L-arabinofuranosyl (1-3) α -L-arabinopyranosyl
2.	Bacoside A3	H	β -D-glucopyranosyl (1-3)-O-(α -L-rabinofuranosyl 1-2) O- β -D-glucopyranosyl
3.	Bacosaponin A	α -L-rabipyranosyl	α -L-arabinopyranosyl
4.	Bacosaponin B	H	α -L-arabinofuranosyl (1-2) α -L-arabinopyranosyl

Pharmacological studies of *Bacopa monnieri*

Bacopa monnieri (Brahmi) is a reputed tonic to improve brain function in Ayurvedic literature. It has also some other pharmacological activity that has been discussed briefly.

Anxiety and depression

Both animal and clinical research support Bacopa's traditional use as an anti-anxiety remedy in Ayurvedic medicine. Research using Bacopa extract of 25% bacoside A exerted anxiolytic activity comparable to Lorazepam^[22]. Importantly, the extract not showing any side effects but instead had a memory-enhancing effect. A one-month study over diagnosed anxiety patients with Brahmi syrup resulted in a significant decrease in anxiety symptoms and level of anxiety^[23].

Epilepsy

Bacopa has also been indicated as a remedy for epilepsy in Ayurvedic medicine, but a more recent study also examined the anticonvulsant properties of the extracts in mice and rats with the high dose given IP at least for 10 days^[24,25].

Bronchitis and asthma

Animal studies have already been shown that the Bacopa extracts have relaxant effect on chemically-induced bronchoconstriction. An earlier *in-vitro* study demonstrated a methanol extract of bacopa possessed potent mast cell stabilizing activity comparable to disodium chromoglycate, a commonly used allergy medication. This study indicates the potential usefulness of Bacopa extracts in bronchoconstrictive conditions as well as some allergic conditions^[26].

Gastrointestinal disorders

In vitro, animal studies have investigated the effects of the extract on the gastrointestinal tract. *In vitro* studies have demonstrated direct spasmolytic activity on intestinal smooth muscle^[27]. The study suggests the protective and curative effects over gastric ulcers. A recent *in vitro* study of Bacopa extract demonstrated the anti-microbial activity against *Helicobacter pylori*, bacteria responsible for chronic gastric ulcers^[28].

Cardiovascular effects

Use of Bacopa as a "Cardiotonic" is frequently mentioned in Ayurvedic medicine texts. *In vitro* research using rabbit aorta and pulmonary artery has demonstrated that extract has vasodilatory effect interfering with calcium channel flux in tissue cells^[27].

Hypothyroidism

A study in mice demonstrated high doses of Bacopa extract increased the thyroid hormone, T4 when given orally. This study indicates Bacopa extract dose have a stimulatory effect on thyroid function^[29].

Cancer

In vitro research also shown that Bacopa extract sub fraction also has cytotoxic activity for sarcoma-180 cells. It might be due to inhibition of DNA replication in the cancerous cell line^[30].

CONCLUSION

The therapeutic efficacy of *B.monniери* is extensively used in Indian system of medicine has been established through modern testing and evaluation (pre-clinical and clinical trials) in different disease conditions. These studies establishing the drug in the development for the treatment of various diseases like anxiety, depression, epilepsy, asthma, bronchitis, cardiac problems, hyperthyroidism, gastrointestinal disorders and in case of some cancers also. The medicinal application of this plant and its countless possibilities for investigations still remain in relatively newer areas of its function. Hence, phytochemicals of this plant will enable to exploit its therapeutic use.

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