Bacopa monnieri (L.) Wettst.

Subjects: Plant Sciences

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Bacopa monnieri has been used as a reputed drug in the Indian traditional ayurvedic system for centuries. This medicinal herb with important phytopharmaceuticals has been popularly known as “Brahmi”. In recent years, *B. monnieri* has been extensively studied for its bioactive constituents, constituents responsible for memory enhancing effect, and also its diverse other useful effects. It possesses many pharmacological activities such as antioxidant, gastrointestinal, endocrine, antimicrobial, anti-inflammatory etc. The plant has been also used for the treatment of neurological and neuropsychiatric diseases. Due to its multipurpose therapeutic potential, micropropagation using axillary meristems and *de novo* organogenesis has been extensively studied in the species and is being reviewed. High frequency direct shoot organogenesis can be induced in excised leaf and internode explants in the absence of exogenous phytohormones and the rate of induction is enhanced in the presence of exogenous cytokinins, supplements, growth regulators, etc. Using explants from tissue culture raised plants, direct shoot regeneration leading to production of more than 100 rooted plants/explant within 8–12 weeks period with 85%–100% survival in the field after acclimatization can be expected following optimized protocols. Bioreactor based micropropagation was found to increase the multiplication rate of shoot cultures for the commercial propagation of *B. monnieri* plants. The maximum content of bacosides has been recorded in shoot biomass using an airlift bioreactor system. Further studies for the biosynthesis of bacosides and other secondary metabolites need to be conducted in the species utilizing untransformed shoot cultures in bioreactors.

Bacopa monnieri Bacosides

1. Introduction

Bacopa monnieri L. (Family: Scrophulariaceae), commonly known as ‘Brahmi’, is a perennial and semi- succulent herb which grows in wet, damp, and marshy areas throughout India. It is an ancient medicinal plant with a legendary reputation as a vitalizer of the memory. For 5000 years, it has been used in India to treat epilepsy and insomnia and to reduce herbal sedation and anxiety [1]. This plant is recommended by Indian Materia Medica (Bhavaprakasha Nighantu AD 1500) for the treatment of a wide range of mental conditions, including anxiety, poor cognition, lack of concentration, insomnia, insanity, depression, psychosis, epilepsy, and Alzheimer’s disease [2][3][4][5]. Clinical studies affirm that bacopa based formulations have positive effects on the reconstruction of mental functions in children suffering from attention deficit hyperactivity disorder (ADHD), and contribute to the enhancement of cognitive functions in stroke and epilepsy patients [6][7][8]. Bacosides and triterpenoids which belong to the saponins are compounds attributed to the above activities [9].

2. History and Development

In recent studies, B. monnieri has been placed second in a priority list of the major Indian medicinal plants assessed on the basis of medicinal significance, potential candidate, and commercial value for further research and development [10][11]. It possesses numerous pharmacological activities, including anxiolytic [12], anti-neoplastic [13], anti-depressant [14], anti-ulcerogenic [15], adaptogenic [16], anti-convulsant [17][18][19] etc. This herb acted as a mental chelating agent in the bloodstream which can eliminate any excess of toxic metals. It is also used for the removal of heavy metals such as chromium and cadmium in phytoremediation. Since B. monnieri is the lone herbal source of bacosides, it is harvested at a very high rate from its natural habitat by pharmacologists and herbal traders. Due to its immense diverse medicinal importance, generation of mass propagation of the plants as well as other alternative strategies for biotechnological production of its active principles, the bacopa saponins, have attracted the attention of researchers resulting in large number of publications on in vitro propagation in the species. The morphogenic potential of explants of B. monnieri favors its use as a model plant for in vitro studies on the expression of transgenes on organogenesis in vitro and functional studies on bacoside synthesis in vitro, avoiding the effects of exogenous phytohormones.

3. Findings

The medicinal and pharmacological importance of bacopa is increasing daily. *B. monnieri* shows massive potential to relieve various neuropharmacological, inflammation, depressions, and other disorders. For future, however, voluminous research is required to verify its efficacy for various disorders. The ethanolic and methanolic extract of bacopa plays a crucial role in treating human diseases at varying concentrations. Bacoside A is the extensive chemical agent responsible for therapeutic effects identified across various research models. Nevertheless, further studies are required to determine the targeted activity of the bioactive compounds present in the isolated bacoside fraction of BM. The antioxidant activity of bacopa may be useful to treat human pathologies in which free radical production plays a crucial role, which requires further research. Biomedical study of bacopa is still in its formative years, but preliminary results like those depicted in this review can definitely open the floodgates to young researchers.

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