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DK Patel
Department of Rural
Technology, Guru Ghasidas
Vishwavidyalaya, (A Central
University), Bilaspur, 495009,
Chhattisgarh, India.

Regeneration of *Bacopa monnieri* (L.) Pennell in Herbal garden

DK Patel

Abstract

Herbal garden is a center for ex-situ conservation of varied Medicinal and Aromatic plants. It is developed aimed for protection as well as for regeneration of various Medicinal and Aromatic plants in certain ecological areas. *Bacopa monnieri* (L.) Pennell is an herbaceous, prostrate nature Medicinal plant. It is marked as useful for preparation of brain tonic. The plant is well adapted to regenerate using their stem cutting.

Each one nodular part of the stem performing as a center for production of its roots at below and upper side producing stem and leaves. It is not producing seeds but well regenerating using its vegetative parts like stem cutting in the presence of the suitable environmental condition. It is well adapted to grow in almost all type of soil.

Stem cutting are efficient to develop in to new individuals of the same Medicinal plant. Usefulness of the same mode of its regeneration was studied and changes recorded and discussed further more.

Keywords: Stem cutting, Vegetative Propagation, *Bacopa monnieri* (L.) Pennell, Herbal Garden.

Introduction

Plants are showing major diversity in different ecological areas based on their adaptability as well as their genes effects. A changeable environmental components performing its role in their growth and development and also leading to form a plant community in certain habitats. Plants are also a source of many medicines so, used in human community in different preparations and for various purposes. A certain chemical compounds in plant cells marked them suitable for treatment of specific disorders.

Forest is a major source of natural habitats of several plant species. Maximum number of the Medicinal and Aromatic plants are collected from this sites but based on significance some species are cultivated regularly for generation of economy among the farmers. From starting to ending of their life the plants are facing many interactions that may be with biotic agents or with environmental components. Struggle can be observed at any stage of the plant life. Tolerance capacity of the plants supports their presence in specific natural habitat.

Plants are registered as a group of wide adaptability in nature following varied modifications based on specific targets. Plants are performing wide range of seed production as well as unique in its dispersal modes. The plants which does not producing seeds are adapted to regenerates using their vegetative modes like by using root, stem, leaf of their modified plant parts like bulb, tuber, rhizomes etc.

The stem of *Bacopa monnieri* (L.) Pennell is an herbaceous, prostrate nature bearing oval shaped small leaves. Nodular part of the stem generating new roots and stems to develop the new plants referred as vegetative propagation. The plant *Bacopa monnieri* (L.) Pennell is not capable to produce seeds and well registered for their regeneration using their mature stem cuttings. Sandy soil/black soil is more suitable for this plant to regenerate in wide range.

Avanigadda and Vangalapati 2011 ^[1] Reviewed on pharmacological studies of *Bacopa monnieri* (L.) Bhattacharya and Ghoshal 1998 ^[2] find out anxiolytic activity of a standardized extract of *Bacopa monnieri* (L.): an experimental study. Chatterji *et al.* 1965 ^[3] done chemical examination of *Bacopa monnieri* (L.): parti-isolation of chemical constituents. Esmail and Snafi 2013 ^[4] recorded the pharmacology of *Bacopa monnieri* (L.). A review. Joshi *et al.* 2010 ^[5] experimented high frequency of shoot regeneration on leaf explants of *Bacopa monnieri*.

Shrivastava 1999 ^[9] experimented on multiple shoot regeneration and tissue culture studies on *Bacopa monnieri* (L.) Pennell. Mohanta and Sahoo 2014 ^[7] have done In Vitro Culture of Highly Valuable Medicinal Plant *Bacopa Monnieri* (L.) Pennell for Rapid and Mass

Correspondence
D. K. Patel
Department of Rural
Technology, Guru Ghasidas
Vishwavidyalaya, (A Central
University), Bilaspur, 495009,
Chhattisgarh, India.

Multiplication. Sairam *et al.* 2001 ^[8] analyzed prophylactic and curative effects of *Bacopa monnieri* in gastric ulcer models. Mathur *et al.* 2010 ^[6] noticed pharmacological investigation of *Bacopa monnieri* on the basis of antioxidant, antimicrobial and anti-inflammatory properties. Neuro-psychopharmacological effects of the Ayurvedic nootropic *Bacopa monnieri* Linn. (Brahmi) was done by Singh and Dhawan 1997 ^[10]. Tiwari *et al.* 2006 ^[14] studied shoot bud regeneration from different explants of *Bacopa monnieri* (L.) Wettst. by trimethoprim and bavistin. Singh and Singh 1980 ^[11] studied on the anti-anxiety effect of the Medhya Rasayana drug, Brahmi (*Bacopa monnieri* Wettst.) – Part 1. Vohra *et al.* 1997 ^[15] studied analgesic activity of bacosine, a new triterpene isolated from *Bacopa monnieri*. Srivastava *et al.* 2009 ^[12] focused on *Bacopa monnieri* - a Future Perspective. Tejavathi *et al.* 2001 ^[13] experimented on micropropagation of *Bacopa monnieri* using shoot tip and nodal explants.

Material and Methods

Mature plants were identified for the selection of the stem. Stem cutting of 18 cm length were cut carefully from mother plant without damaging it. These plant parts (Stem cutting) were further applied for generation of new shoot and root for development of the new plants.

Properly field selection and preparation was made following removal of weeds and supply of nutrients.

Stem cuttings were grown in field directly and also it developed in poly bags of 13 cm deep and width of 8 cm by Deeping the stem cutting of 6 cm to make easy for further transfer from one place to another. As the plant is of a water loving tendency so moisture level always maintained near the plant to provide them a better environmental condition needed for successful development of roots and shoots from grown stem cutting.

Deeping overnight of selected/cut stem cutting provide easily root ignition in the stem nodular part. Proper observations were made for its successful regeneration and for ex-situ conservation in a protected area (Herbal Garden) aimed for the same purpose.

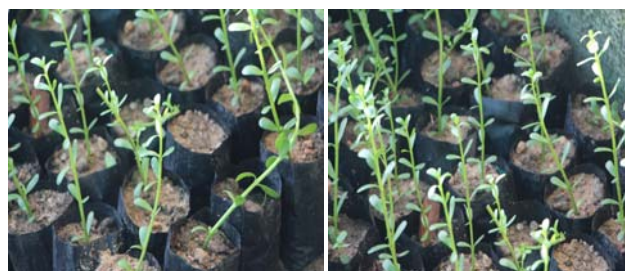
Regeneration changes of varied stages of plant



On 0 Day - 18 July 2015



After 10 Days - 28 July 2015



After 20 Days - 8 August 2015





After 30 Days - 18 August 2015



Shifting of Developed plants in Beds in Herbal Garden
20 August 2015

Morphological observations



Result and Discussions

The plant is moist loving in nature need for much water for its proper growth and development. Near small water bodies it is spreading by developing new branches, leaves and roots.

ROOT – Small roots originating from nodes and grow in soil at around 5 – 10 cm depth, Diameter 0.5 – 1.0 cm. The plant is well propagating in sandy soil.

STEM- Green, Cylindrical, Smooth, Branched bearing leaves and flowers, Stem diameter 1 – 1.5 cm, Internodes 3 – 6 cm long. **LEAF** – Leaves are oval in shape, Fleshy, Green, Small in size, Alternate arrangement on stem, Leaf length 1.5 – 2.5 cm, Leaf broad 0.5 – 1.0 cm. **FLOWER** – The plant producing white, Pentamerous, Small size flowers present on mature plant.

The plant is not producing Seeds but showing efficient potential in vegetative propagation using its mature stem cuttings. Stem cuttings used for above purpose requires to present 4-6 nodes. In initial stage of its cultivation it requires a moderate irrigation.

Each one mature nodular part of this plant is efficiently producing new root and shoot system in favourable environmental condition which further support to develop its new individuals like their parental ones. Stem cuttings of the plant are applied to grow it directly in prepared beds and also are developed in to new plant in poly bags in Herbal Garden for its regeneration and conservation.

Comparatively the plant requires much water than others. The plant registered for its rapid spreading around the sites of its cultivation. After establishment of this plant it gradually developing new plant parts and a cover made by the plant near of its plantation.

Due to rich potential in use in varied medicinal purpose the plant is very useful need for cultivation in large scale as well as also need for proper multiplication and conservation to maintain the plants species diversity in nature.

New individual developed in poly bags (using stem cutting) are after maturation transferred to the selected fields/beds in Herbal garden with proper water supply. Weed removal, Nutrient supply etc made as per need of the plant in field.

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