International Journal of Advanced Research in Engineering Technology & Science

ISSN: 2349-2819

Email: editor@ijarets.org Volume-8, Issue-3 March – 2021 www.ijarets.org

Vegetative propagation methods of *Rosemarinus officinalis* and their role in income generating activities in kumaun himalayas

Kapil Khulbe and Kavita Mehata*

***Department of Botany, Kumaun Univeristy,

Nainital, Uttarakhad, India

Abstract

In this study, the vegetative growth techniques of *Rosmarinus officinalis* (also known as rosemary) are investigated, as well as the relevance of these methods in terms of activities that generate revenue in the Kumaun Himalaya. The purpose of this study is to evaluate the efficacy of various propagation strategies, including stem cuttings, layering, and division, by analyzing their success rates, growth metrics, and adaptation to the environmental conditions of the local area. Stem cuttings, particularly those that have been treated with rooting hormones, have been shown to have the best success rates and strong growth throughout the course of many field experiments, according to the data obtained. Despite the fact that they are practical, the procedures of layering and division indicate lesser efficiency and require more effort. The results of this study highlight the potential of rosemary production as a sustainable agricultural practice that has the ability to improve the livelihoods of the communities on which it is grown. A varied revenue stream may be obtained by the incorporation of rosemary farming into pre-existing agricultural systems, which in turn contributes to the region's economic stability and resilience. This study emphasizes the significance of developing vegetative propagation techniques and offering training to farmers in order to optimize the economic advantages that may be derived from rosemary growing in the Kumaun Himalayas.

Keywords: *Rosemarinus officinalis*, Propogation, Kumaun Himalaya

Introduction

Rosemary (*Rosmarinus officinalis*), is a perennial plant that is recognized for its fragrant leaves and essential oils. It is widely utilized in a variety of uses, including cosmetics, culinary applications, and medical applications. The Mediterranean region is where rosemary was first discovered, but it has since adapted to a wide range of temperatures, including the temperate conditions that may be found in the Kumaun Himalayas. The herb's resistance to damage and its wide range of applications make it an appealing crop for environmentally responsible agriculture and income generation. Traditional agricultural methods are frequently put to the test in the Kumaun Himalayas due to the region's harsh topography, limited fertile land, and varying meteorological conditions. Increasing the variety of agricultural methods to include high-value crops like rosemary may provide a workable answer to the problems that have been identified.

Vegetative propagation, which is a form of plant reproduction that involves the use of vegetative elements such as stems, leaves, or roots, is particularly well-suited for the development of rosemary due to the fact that it is straightforward and has a high success rate. This research investigates the vegetative propagation strategies of *Rosmarinus officinalis* with the purpose of determining which procedures are the most successful for farmers in the surrounding area. Through the comparison of techniques such as stem cuttings, layering, and division, the purpose of this research is to give suggestions that can be put into practice to maximize the production of rosemary. Additionally, the research investigates the economic potential of rosemary cultivation as a source of income for communities located in the Kumaun Himalayas, which is a region where agriculture plays a significant part in the livelihoods of the local population.

There are several advantages that may be gained by incorporating rosemary into preexisting agricultural systems. It increases the biodiversity of the area, promotes the health of the soil, and gives a consistent income via the sale of a variety of goods that contain rosemary. The findings of this study highlight the significance of implementing novel farming techniques and capitalizing on the economic potential of high-value crops in order to enhance the long-term viability and economic well-being of rural communities located in the Kumaun Himalayas.

This research is to contribute to the development of a healthy and diverse agricultural sector in the region by fostering effective vegetative propagation methods and giving support for rosemary cultivation. Specifically, the research will focus on rosemary cultivation. Those who are committed to improving rural living via sustainable agriculture will find the findings to be an invaluable resource. This includes agricultural extension workers, farmers, and policymakers.

Materials and Methods

The herbaceous plant known as *Rosemarinus officinalis*, which belongs to the Lamiaceae family, was chosen to serve as the experimental material. Beginning in May 2017 and continuing through July 2017, the experiment was conducted in a glasshouse that was part of the Department of Botany at Kumaun University's D.S.B Campus Nainital.

Stem-cutting Collection

Rosemary stem cuttings were removed from TERI (The Energy and Resource Institute), Supi, and Mukteshwar, Uttarakhand and then transported inside the laboratory in plastic bags to prevent them from drying out at room temperature. During the process of collecting the cuttings, it was made certain that the cuttings were picked from plants that were fully matured and there were no signs of illness. The stem cuttings were gathered during the last week of May in the year 2017.

Explant Treatment

In spite of the fact that there is no rooting medium that is optimal or universal for cuttings (Hartmann et al., 1997), no propagation approach is going to be successful if the appropriate medium for development is not utilized (Berhe & Negash, 1998). According to Hartmann et al. (1990), a medium is considered acceptable for propagation if it is suited for the species, the cutting type, the season, the propagation technique that is employed, the cost, and the availability of the medium. According to Hartmann et al. (1990), an optimal propagation medium must have the following characteristics: it must be devoid of disease-causing pathogens; it must also supply the cuttings with adequate aeration, hydration, drainage, support, and nutrients. The growth hormone IBA, which was procured from Hi-media Laboratory Pvt. Ltd. in Mumbai, India, was chosen for the experiment on rooting. Within the context of the rooting studies, the selected stems were each individually submerged in a concentration of 500 ppm of hormone, which included the control. At room temperature, the cuttings were treated with the test chemical by immersing their basal regions of 2.0 centimeters in the test solution for a period of twenty-four hours. For the purpose of reducing the amount of transpiration, about three-quarters of the leaf surface of each cutting was removed. One set of clippings that had not been treated served as the control. Each treatment included 180 plants that were exposed to 500 ppm of IBA hormone, whereas the control group consisted of 90 plants.

The IBA solution is 500 parts per million in 250 milliliters of distilled water.

Method: – 1ppm = 1ml

= 0.001g/

For 500x of stock= 500 x 0.001g/l

= 0.5 g/l

For making 250ml = 0.5/4 = 0.125g/250ml

Procedure:-

1. Measure 0.125 of IBA
2. Pour IBA into a test tube and add 1-2ml of NaOH in the test tube.
3. Make up the volume to 250ml by adding distilled water to the solution of NaOH and IBA (8.125g/250ml)
4. NaOH used in lesser amount only to dissolve IBA because PGH's does not dissolve in water so we use NaOH or ethanol.

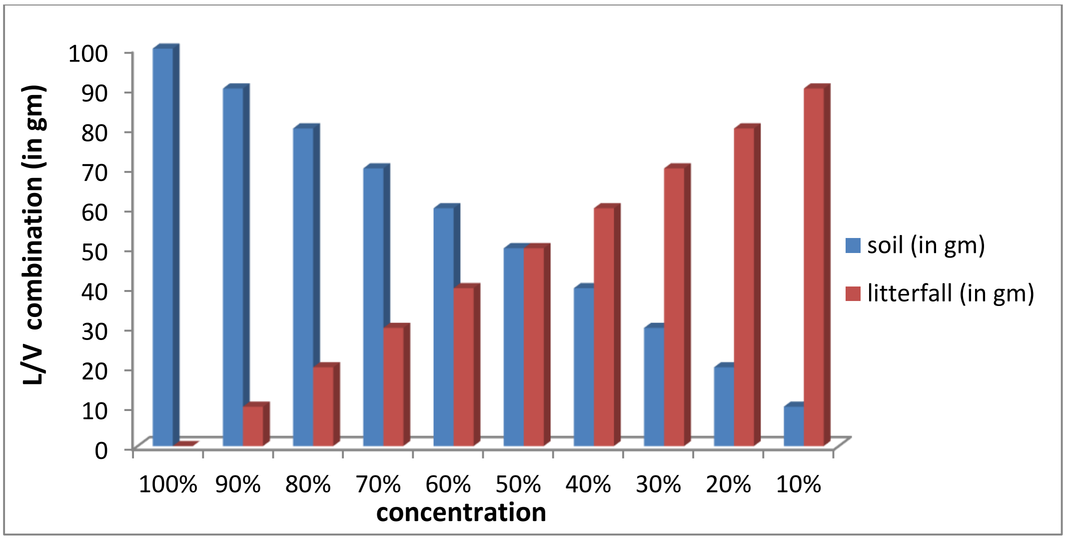
Different Concentration of soil, vermicompost and litter fall

The species were subjected to yet another experiment in which they were treated with a variety of soil, vermicompost, and litter fall mixtures. A mixture of the following was applied to the species to:

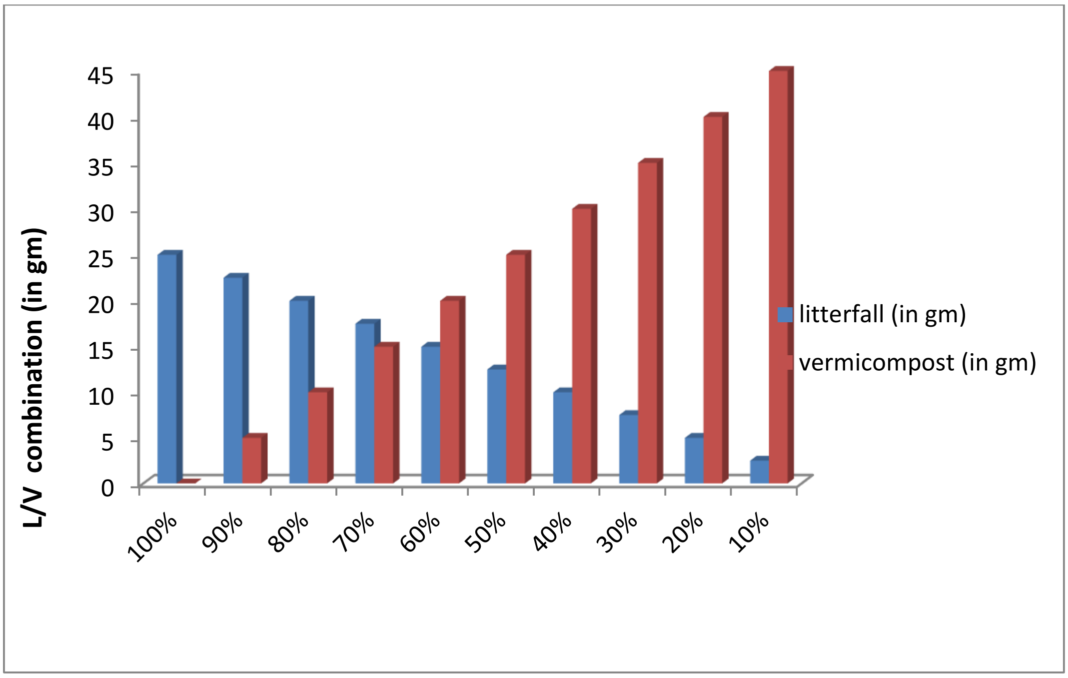
a) Soil and litter fall
b) Litter fall and vermicompost
c) Vermicompost and soil

These combinations of soil, vermicompost and litter fall then filled in the root trainers after weighing. Plants then were planted in the root trainers. After 6 weeks plants were taken out from the root trainers. During this stage rooting, disease incidence and above ground growth was observed.

a) Soil and Litter fall



b) Litter fall and vermicompost



Rooting Conditions

The experiments were carried out inside the glasshouse, made up of translucent polythene sheet. The relative humidity inside the glasshouse is very high. Plants were regularly observed and irrigated by hand, depending on the weather conditions and growth of the plant.

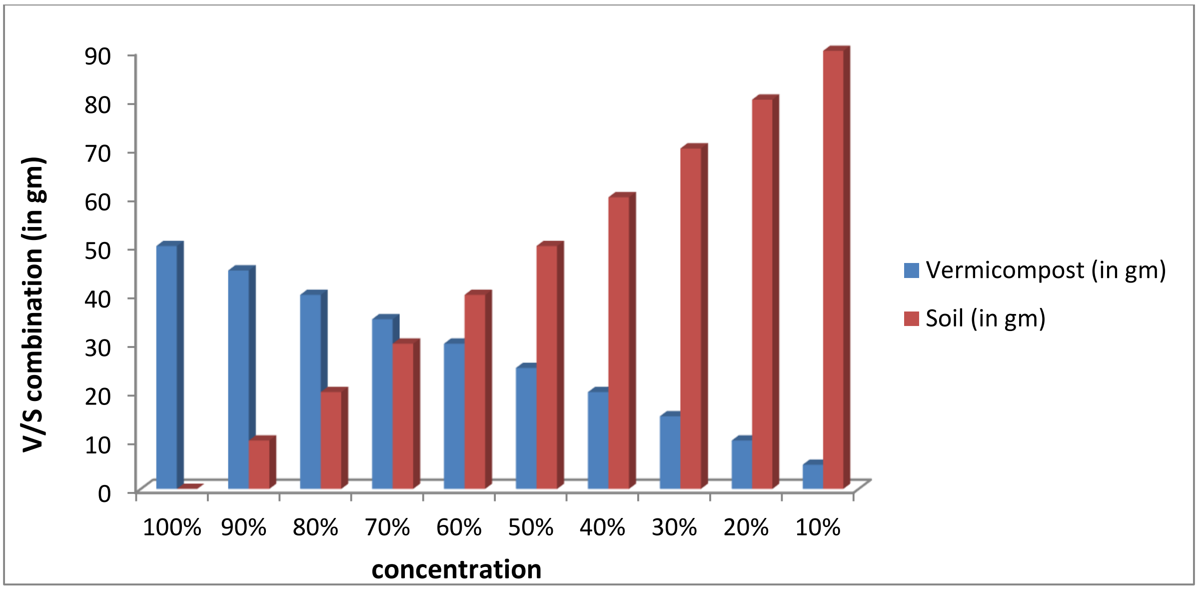
Data Recording

Based on regular observations, root initiation in majority of cuttings was first noticed during 6th week, and therefore final data were recorded during 7th week after plantation of cuttings. After data recording these plantlets were re-transplanted in polythene bags containing normal soil and kept inside the polyhouse to monitor the growth and survival of rooted cuttings.

Growth and Survival of Rooted Cuttings

All the rooted cuttings were kept inside the polyhouse from July, 2017. To record percentage of survival of *Rosemarinus officinalis,* shoot height, rootings in the stem cuttings and disease incidence were recorded.

c) Vermicompost and soil



Result and Discussion

Influence of Rooting Hormone

It was noticed that the plants that were treated with the Rooting hormone IBA resulted in the development of fibrous roots. Up to seven weeks after the treatments were administered, the rooting capacity of stem cuttings of *Rosemarinus officinaalis* was seen to be affected by the treatments. As early as the sixth week, root initiation was noted. Maximum rooting was achieved by combining a concentration of 500 ppm IBA with a soil composition of 100%-90% and a leaf litter composition of 0%-10%, respectively.

Rooting in the Control treatment

Only in the percentage of cuttings that were treated with the control did rooting appear to be noticed. There was no difference in the concentration of soil, vermicompost, or leaf litter between the plants that were treated with rooting homone and those that were not (table 1).

Disease incidence

Despite the fact that rosemary is resistant to the majority of diseases, the majority of the plants were unable to maintain their survival owing to the unfavorable conditions. The experiment was carried out in the mist chamber housed within the Botany department, which has a humidity level that is around 80 percent. As a result of the high moisture content in the mist chamber, the majority of the plants were unable to survive when they were attacked by fungi and insects respectively. The harsh conditions and the occurrence of illness in the plants led to a fall in the survival rate of the plants. Approximately ninety percent of the plants that were not treated with the IBA hormone exhibited the disease incidence (table.2), however the plants that were treated with the IBA hormone were less affected by the illness, as only thirty-five percent of them were sick (table 1). Due to the fact that rosemary plants do not require a high moisture content for their growth, a high concentration of vermicompost that is greater than sixty percent is not ideal for the growth of the plant, as seen in table 1. In comparison to the plants that were treated, the plants that were managed had a lower level of resistance to the occurrence of the illness.

Above Ground Growth

Out of all the different concentrations, the plants that were treated with 500 ppm of hormone in soil that was 100%-90% soil and litter that was 0%-10% correspondingly showed the highest root initiation and the highest biomass.

Table 1 Rooting in stem cuttings of *Rosemarinus officinalis* tested under several conditions, including soil, vermicompost, and leaf litter, as well as rooting hormone IBA (500ppm)

S/L	**L/V**	**V/S**						
CONC. (In %)	ROOTING	DRY WEIGHT	CONC. (In %)	ROOTING	DRY WEIGHT	CONC. (In %)	ROOTING	DRY WEIGHT
S100	6plants	.10g	L100	Absent	-	V100	Absent	-
S90	6plants	.09g	L90	Absent	-	V90	Absent	-
S80	1plant	.09g	L80	1 plant	.02g	V80	Absent	-
S70	1plant	.08g	L70	Absent	-	V70	Absent	-
S60	3plants	.02g	L60	Absent	-	V60	3 plants	.05g
S50	1plant	.04g	L50	1 plant	.08g	V50	1 plant	.05g
S40	Absent	-	L40	1 plant	.05g	V40	2 plants	.02g
S30	Absent	-	L30	2 plants	-	V30	1 plant	.09g
S20	Absent	-	L20	1 plant	.08g	V20	4 plants	.05g
S10	Absent	-	L10	Absent	-	V10	4 plants	.02g

S= soil ; S/L= soil + litter fall
L= litter fall ; L/V= litter fall + vermicompost
V= vermicompost ; V/S= vermicompost + litter fall

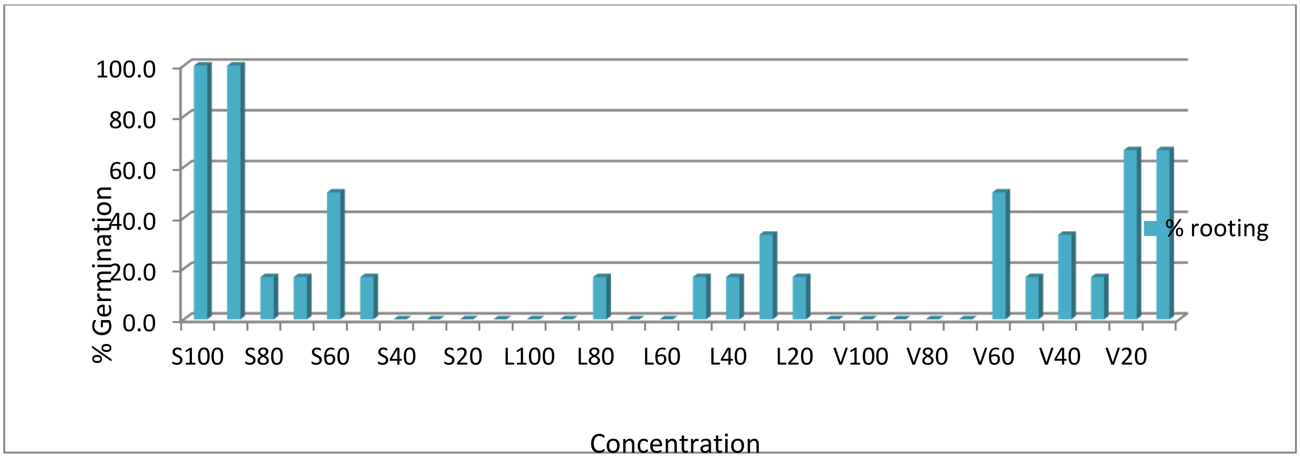


Fig 1: Graphical representation of rooting % in the stem cutting of Rosemary by the influence of 500ppm IBA hormone

Table 2- Distilled water treatment (control)

S/L	**L/V**	**V/S**						
CONC. (In %)	**ROOTING**	**DRY WEIGHT**	**CONC. (In %)**	**ROOTING**	**DRY WEIGHT**	**CONC. (In %)**	**ROOTING**	**DRY WEIGHT**
S100	2 plants	.01g	L100	Absent	-	V100	Absent	-
S90	2 plants	.02g	L90	Absent	-	V90	Absent	-
S80	Absent	-	L80	Absent	-	V80	Absent	-
S70	Absent	-	L70	Absent	-	V70	Absent	-
S60	Absent	-	L60	Absent	-	V60	Absent	-
S50	Absent	-	L50	Absent	-	V50	Absent	-
S40	Absent	-	L40	Absent	-	V40	Absent	-
S30	Absent	-	L30	Absent	-	V30	Absent	-
S20	Absent	-	L20	Absent	-	V20	Absent	-
S10	Absent	-	L10	Absent	-	V10	1 plant	.05g

S= soil ; S/L= soil + litter fall

L= litter fall ; L/V= litter fall + vermicompost

V= vermicompost ; V/S= vermicompost + litter fall

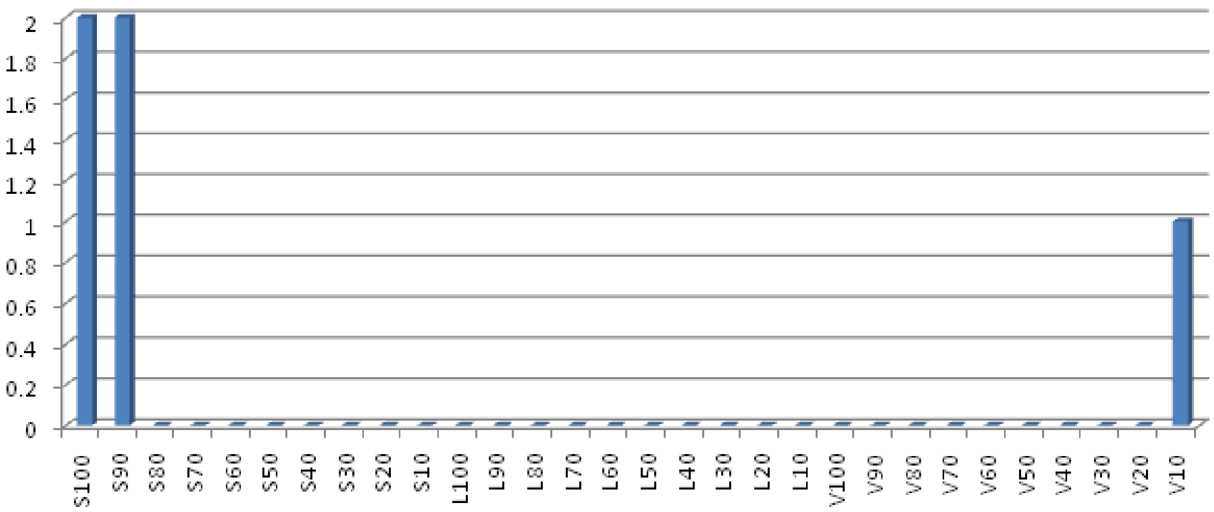


Fig 2: Graphical representation of rooting in the stem cutting of Rosemary untreated by the IBA hormone (control)

Conclusion

This research has shown that growing rosemary (*Rosmarinus officinalis*) in the Kumaun Himalayas using vegetative propagation techniques has a lot of promise. Stem cuttings, especially when treated with rooting hormones, demonstrated the highest success rates and most robust plant development of the procedures tested. Stem cuttings are the method of choice for local farmers because to their efficiency and lack of labor-intensiveness compared to layering and dividing. Economic development and agricultural diversification can be greatly enhanced with the effective proliferation and cultivation of rosemary in the Kumaun Himalayas. Rosemary is a sustainable and lucrative crop alternative due to its resilience to the region's climatic conditions and its diverse applications. An increase in revenue from the sale of fresh and dried herbs, essential oils, and value-added items like soaps and cosmetics may be achieved through the incorporation of rosemary cultivation into current agricultural systems. By enhancing soil health and promoting biodiversity, rosemary production can also help to environmental sustainability. The study's results highlight the need to help farmers by providing them with training and tools so they can reap the economic benefits of growing rosemary to its fullest. Finally, rural populations in the Kumaun Himalayas have a lot to gain economically from cultivating rosemary using efficient vegetative propagation methods. This research helps strengthen and diversify the region's agricultural economy by offering practical guidance and showcasing the economic potential of high-value crops like rosemary. Achieving long-term economic stability and environmental sustainability in the Kumaun Himalayas will need ongoing efforts to support local farmers and promote sustainable agriculture techniques.

Reference

[1] Aziza Kamal Genena; Haiko Hense, ; Artur Smania Junior; Simone Machado de Souza a study of the composition, antioxidant and antimicrobial activities of extracts obtained with supercritical carbon dioxide vol.28 no.2 Campinas Apr./June 2008

[2] Barata, A.M., Asdal, A., 2012. Medicinal and Aromatic Plants ECPGR Working Group: objectives and achievements. In: Maxted, Nigel, et al. (Eds.), Agro biodiversity Conservation. Security the Diversity of crop wild relatives and landraces, 36, Part V, pp. 292–297.B

[3] Bisht, A.K. Bhatt, A. Rawal and Dhar. 2006. Prioritization and conservation of Himalayan Medicinal Plants: Angelica glaucaEdgew. as a case study. Ethno botany Research and Applications. 4: 11-24

[4] Bown D (1995) Encyclopaedia of Herbs and their Uses. New York, DK Publishing, Inc., pp. 12-49.

[5] Brower V. Back to nature: Extinction of medicinal plants threatens drug discovery. J Natl Cancer Inst 2008, 100 (12):838-839.

[6] Champion, H.G. and S.K. Seth. 1968. A revised survey of forest types of India. Government of India Publication Division, New Delhi.

[7] Chakravarti S,Raghuvanshi SS (2005) Rosemary (Rosemarinusofficinalis): a useful medicinal herb. Vaniki-Sandesh, 29: 26-27.

[8] Chauhan VK, Jagmohan S,Srivastava LJ (1992) Initiation of rooting in stem cuttings of rosemary through hormonal treatments. Indian Journal of Forestry, 15: 131-135.

[9] Deen SE, Mahmoud M (1996) Comperative study between saponin and natural auxin on root growth of Rosemary (Rosmarinusofficinalis) cutting. ActaHorticulturae, 426, 635-642.

[10] Del Bano AJ, Lorente J, Castillo J, Benavente-Garcia O, Del Rio JA, et al. (2003) Phenolic diterpenes, flavones, and rosmarinic acid distribution during the development of leaves, flowers, stems, and roots of Rosmarinusofficinalis. Antioxidant activity. Journal of Agricultural and Food Chemistry, 51, 4247-4253.

[11] Dhar, Rawal and Upreti, 2000 and 2002. Setting priorities for conservation of medicinal plants- a case study in the Indian Himalaya. Biological Conservation. 95: 57-65.

[12] Duke JA (2001) Hand Book of Medical Herbs. Boca Raton, FL: CRC press, p. 677.

[13] Duke JA, Ayensu ES (1985) Medicinal Plants of China. Reference Publications, Inc., ISBN: 0-917256-20-4. Ecosystem services and its mainstreaming in development planning process (Editors: V.K