

Conservation and Sustainable Utilization of High Altitude Medicinal Plants in Indian Himalayan Region

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ABSTRACT: The conservation of high altitude medicinal and aromatic plants of Himalayan region remains a main concern among the environmentalist. Due to severe climatic conditions and specific adaptation strategies plants in high altitudes prefers specific microclimate and therefore many of them are endemic. Over exploitation for medicinal and other uses make these plants vulnerable and many of them are identified as threatened plants. Keeping in view conservation needs, the present paper describe ongoing conservation initiatives as well as suggesting new approaches with mainly focusing on sustainable utilization by *ex-situ* cultivation.

INTRODUCTION

Medicinal and aromatic plants (MAPs) are gaining popularity globally as a source of raw material for pharmaceuticals and traditional systems as principal health care resources from time immemorial [1]. The widespread use of herbal remedies and healthcare preparations were also described in ancient Hindu Scriptures such as Rig-Veda. Due to better cultural acceptability, better compatibility with the human body and lesser side effects, the demand of herbal medicines for the treatment of various ailments steadily increased all over the world. More than 85% of herbal medicines used in health care systems are derived from MAPs and ensure the livelihoods of millions people, especially in the Indian Himalayan region [2]. MAPs offers wide variety of products, from crude materials to processed and packaged products like pharmaceuticals, herbal remedies, teas, sweets, dietary supplements, varnishes and insecticides [3]. The importance of medicinal plants in global economy is indicated by the fact that WHO has estimated the present demand of medicinal plants approximately US \$ 14 billion per year and it is likely to increase more than US \$5 trillion in 2050 [4].

The Himalayan range is a vast mountain system extending into eight developing countries in South Asia viz., Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan. India is recognized as mega-diversity country and as one of the 10 most extensively forested areas in the world. Although it covers only 18% of India's

geographical area, the Indian Himalaya accounts for more than 50% of the country's forest cover and 40% of the species endemic to this subcontinent.

The Indian Himalayan Region (IHR) is a mega hot spot of biological diversity. It stretches from Jammu and Kashmir in the north-west to Arunachal Pradesh in the East [5]. It lies between 27°50'-37°6' N latitude and 72°30'-97°25'E longitude, covering approximately an area of 4,19,873 km² with 2500 km length 240 km width. The entire Himalayan region, with wide altitudinal variations, different habitat types and varying microclimatic conditions, particularly in alpine zone forms ideal environment for the proper growth and development of MAPs [6]. However, due to extreme climatic and ecological conditions, MAPs of alpine zone possess attractive appearance, interesting mode of perennation, morphological, physiological and adaptation features. More importantly, the MAPs of this zone synthesize some specific secondary metabolites and therefore, offer greater possibilities of having novel bio-molecules and even larger quantity of active components [7]. Approximately 1,748 species of Medicinal and Aromatic Plants (MAPs) are reported from the Indian Himalayan Region [8]. Most of the MAP species are found in difficult terrain in high altitude regions of Himalaya and thus very little information is available on variability and multiplication of these species.