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Review article

In perspective: Potential medicinal plant resources of Kashmir Himalayas, their domestication and cultivation for commercial exploitation

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ABSTRACT

The rich biodiversity of India and its extensive use since millennia for overall healthcare system has found renewed interest due to recent advances in modern biology, pharmacology, chemistry and other cognate disciplines. The concept of traditional medicine integrated with modern medicine has given birth to 'Green Medicine'. It has been proven to be more efficacious with least side effects on human beings. In India large number of medicinal plants from the compendium of Ayurveda, Unani and Sidha systems are being regularly employed in treating various ailments and diseases. The Northern extreme of India, the Kashmir Himalayas harbour remarkably rich wealth of medicinally important herbs and a number of these provide bulk of raw materials to the Indian pharmaceutical industry. However, harvesting of these plants from their natural habitats has resulted in serious depletion of many such herbs. The collated information presented here reviews potential of medicinal plant resources in terms their biologically active constituents and significance in the treatment of various diseases and ailments. This paper also highlights the importance of captive cultivation as a viable alternative that guarantees constant supply of raw materials to pharmaceutical industry and livelihood to the people. Additionally, it also entails the imperativeness of conventional breeding methods that can lead to genetic amelioration of various agronomic and medicinal attributes of the plant species. Above all, understanding of the biosynthetic pathways in different groups of plants is an important aspect for enhanced secondary metabolite production through biotechnological interventions. Except for only few reports, a large number of medicinal species from Kashmir Himalayas are yet to be scrutinized for their genomics, transcriptomics, proteomics and metabolomic facets for developing designer genotypes and chemotypes.

1. Introduction

The medicinal plants have remained source for herbal drugs since antiquity. The medicinal properties of herbal drugs are attributed to bioactive secondary metabolites (Croteau et al., 2000). Over the last two decades, the naturally growing medicinal plants have attained significant popularity as a source of raw material for traditional health care systems and pharmaceuticals. According to an estimate more than 85% of herbal medicines used in traditional health care systems are obtained from medicinal plants (Prasad and Bhattacharya, 2003; Phondani et al., 2014). World Health Organisation (WHO) in 2002 reported that 70% of the world's population depend on Traditional Health Care System (THCS) for the treatment of a number of ailments and diseases. About one quarter of all prescribed drugs contain compounds that are directly derived from the plants. Many of the top selling drugs are natural products. This upsurge is primarily due to the fact alternative systems of medicine result in minimal side effects and are also affordable to large sections of poor population. As such, in many

developing countries viz. Bangladesh (90%), Myanmar (85%), India (80%), Nepal (75%), Sri Lanka (65%) and Indonesia (60%), mostly rural people are predominantly dependent on this system of medicine. According to WHO, the estimated global market for the medicinal plants and herbal medicine is worth US \$ 14 billion per year (Sharma, 2010) and US \$ 1 billion per year in India (Joshi et al., 2009a, 2009b). It has also been estimated by WHO that the demand of plant based raw materials is growing annually at a rate of 15–25% which is projected to increase up to more than US \$5 trillion by the year 2050 (Kala et al., 2006). According to Shahid et al. (2013), with an increasing global demand of herbal medicines, there is a need for large quantity of quality herbal raw materials where active principles are available in desired concentration. Further, it is often difficult to synthesize complex natural compounds through synthetic chemistry as the whole process is economically prohibitive. Thus, plants remain to a greater extent sole sustainable natural resource of many medicinally important secondary metabolites.

The natural products from plants have been persistently used as

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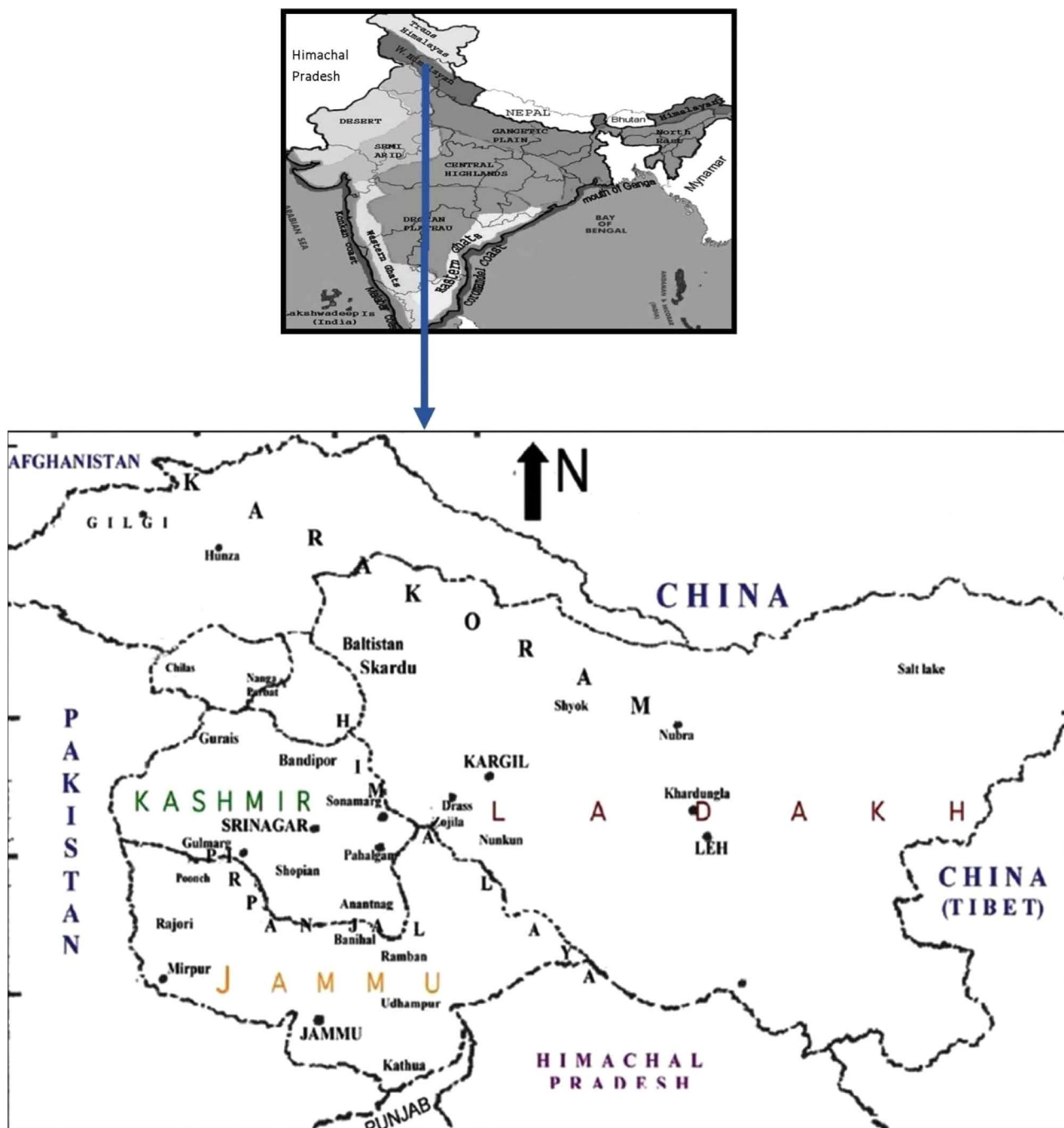


Fig. 1. Geographical location of Kashmir Himalayas.

pharmaceuticals, additives, pesticides, agrochemicals, flavour and fragrance ingredients, food additives etc. Most of these plant derived natural products have proved to be the important source of traditional as well as modern medicine. The Food and Drug Administration introduced 13 new drugs of natural origin along with more than 100 natural product-based drugs in clinical studies (Li and Vederas, 2011). In Western medicine, around 40–45% drugs are natural products or compounds derived from them, of which 25% have plant origin (Dhar et al., 2014). Today the dietary ingredients of plant derived natural compounds have gradually become significant part of human nutrition from a health perspective (Choi et al., 2012). These chemical entities (secondary metabolites) in the form of natural products do not contribute directly in growth and development of a plant but have a significant role in plant survival under specialized ecological conditions.

These metabolites are often restricted in distribution and are mostly specific to particular taxonomic group or a plant species.

1.1. Medicinal plants diversity in India

India ranks second after china in the usage of medicinal plants for traditional applications (Chen et al., 2016). From India, of the 18,000 species of higher plants, 7500 are reported for medicinal usage (Chen et al., 2016). In Asia, India is one of the leading countries in terms of the wealth of traditional knowledge systems and employs a large number of plant species in Ayurveda (2000 plants), Siddha (1121 plants), Unani (751 plants) and Tibetan (337 plants) systems of medicine (Kala, 2002; Anonymous, 2004). However, for herbal drug industry about 90% of medicinal plants are obtained from their natural habitats. It makes such

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