

Seabuckthorn Technologies for Development of Value Chain and Environmental Conservation in Himalayas

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Seabuckthorn (*Hippophae* spp.), an important high value medicinal plant found in cold areas of Indian Himalayan Region (IHR). In India, it is reported in Chamoli district of Uttarakhand, cold regions of Leh and Ladakh, Kinuar district of Himachal Pradesh, Sikkim and in Dibang valley in Arunachal Pradesh.

Seabuckthorn considered as wonder berry from the Himalayas is known as nature's most balanced fruit is a highly versatile high-altitude species having a wide range of ecological, medicinal, and economic uses. This hardy species can grow well in the extreme alpine and subalpine environments of the Himalayas, and have the tendency to withstanding at -40°C temperatures, and plays a vital role in nitrogen fixation and soil erosion control through its deep fibrous roots.

The orange-yellow fruits of Seabuckthorn were traditionally used in traditional medicine, food, and cosmetics in Russia, Ladakh, and Mongolia. The berries are now well known for their bioactive compounds are excellent source of omega-7 fatty acids and have vast pharmacological and nutraceutical potential-particularly in cardiovascular health management, diabetes, skin diseases, relief from gastric distress, reduce inflammation, anti-oxidants, anticancer property and immune modulation as shown in Fig. 1. With the world increasingly aware of its potential, Seabuckthorn is now also utilised for biotechnology, product diversification, and entrepreneurship development.

This special issue of Defence Life Science Journal an international, peer-reviewed journal committed to the

interdisciplinary field of defence-related life sciences discusses “Seabuckthorn Technologies for Development of Value Chain and Environmental Conservation in Himalayas”. The origin of this special issue coincides with a national conference held on 5-6 March 2025, at Graphic Era University, Dehradun in association with Seabuckthorn Association of India. The aim of the national conference was to induce action for the conservation, cultivation and entrepreneurship development of Seabuckthorn plant in Uttarakhand state where less it is less explored in comparison to Ladakh and Himachal Pradesh. The conference was meant to unite the farmers, researchers, policymakers, and industries to speed up the use of technology, knowledge transfer, and entrepreneurship in Seabuckthorn. The conference emphasised the requirement of scientific collaboration for bridging regional disparities and facilitating inclusive and climate-resilient livelihoods. It brings together frontier research, field innovations, and policy insights under five broad thematic areas: (i) Ecological distribution and genetic diversity: Information on the indigenous dissemination, genetic variation, and adaptability of Seabuckthorn across the IHR is necessary for efficient conservation and resource planning. Familiarity with its ecological tolerance and genotypic strength forms the foundation for selective breeding and multiplication of quality strains. (ii) Cultivation and conservation of elite populations: Transition to cultivation from wild harvesting is a crucial shift in conserving genetic resources and optimising production. Conservation of quality germplasm, agro-technologies appropriate to various parts of the Himalayas, and propagation techniques are critical to maximum yield and ecological rejuvenation. (iii) Medicinal, pharmaceutical and nutraceutical value: There is great emphasis on unlocking and exploiting the bioactive profiles of Seabuckthorn for therapeutic use. Papers in this issue detail its promise in pharmacological drugs, functional foods, cosmeceuticals, and drug discovery of interest not only in civilian medicine but also for increasing soldier resistance in the battlefield. (iv) Technology development, value chain and commercialisation: As Himachal Pradesh, Ladakh, Sikkim, and Uttarakhand experience the growth of processing industries and Seabuckthorn enterprise, a



Figure 1. Various benefit of Seabuckthorn.

robust value chain establishment becomes the need of the times. Contributions analyze trends in post-harvest management, cold-chain logistics, product development, branding, access to markets, and policy support to enable inclusive growth. (v) Environmental conservation and combating climate change: Seabuckthorn's ecological benefits of land degradation avoidance, wasteland reclamation, and carbon sequestration are central to the restoration of Himalayan ecosystems.

It is our pleasure to publish some of the high-quality peer-reviewed collection of papers in this special issue of Defence Life Science Journal that chronicle the interdisciplinary endeavour in the disciplines of biotechnology, pharmacology, food technology, and environmental science. The studies and reviews presented here are expected to initiate innovation, guide policy, and propel sustainable development in the Himalayas through the multi-faceted promise of Seabuckthorn. This special issue highlights the species' use in climate change adaptation and mitigation strategies, presenting a nature-based solution for sustainable mountain development.

A total of eight good quality publications that underwent peer review and were selected on the basis of originality, innovation and applications are published in this issue. Gupta, *et al.* investigated the antifungal potential of Seabuckthorn against *Rhizopus* species using bioinformatics tool. Mapfumo, *et al.* investigated the bioactive potential of Seabuckthorn against Human Metapneumovirus (HMPV) using computational molecular docking. Rawat, *et al.* carried out the isolation of various microbial community from the rhizosphere of Seabuckthorn and

investigated them for various biotechnological applications. Kaushik, *et al.* explored the morphology, cultivation and economic potential of Seabuckthorn emphasising its nutritional and pharmaceutical applications and focuses on awareness and conservation of this medicinally important plant. Akhtar, *et al.* discussed about the synthesis of Seabuckthorn nanoparticles encompassing their antimicrobial and antioxidant activities. Besides phytochemicals studies, Agarwal, *et al.* primarily focused upon the role of microorganism (exhibiting plant growth promoting activity) isolated from termites to improve the productivity of Seabuckthorn species. Singh, *et al.* studied the significance of bioactive compounds of golden fruit Seabuckthorn in treatment of various health problems and nutritional deficiencies. Thapliyal, *et al.* explored nutritional, medicinal, and ecological significance of Seabuckthorn (*Hippophae rhamnoides*) in relation to environmental sustainability.

This special edition not only resonates with the Defence Life Science Journal's mandate ranging from biomedical sciences to bioengineering, food security, and protection of health in defence contexts but also as a clarion call in the intersection of national health, economic, and ecological security policy with local biodiversity. We acknowledge our gratitude to all the contributing authors, reviewers, and national conference organising committee for their constructive comments in preparing this special issue. We anticipate that the knowledge shared here will inspire additional research, investments, and policy interventions for the sustainable development of Seabuckthorn technologies in the Indian Himalayas and beyond.