ISSN: 2287-688X

Annals of
Plant Sciences

Volume 13, Issue 11 (2024) pp. 6603-6609

Research Article

Pharmacological Significance and Curative Potential of Seabuckthorn-A Traditional Tibetan Medicinal Plant in Cold Desert Himalayas

Kamlesh Kumari and Remya Krishnan

Department of Botany, Daulat Ram College, University of Delhi

Abstract

The Himalayan region, including the cold deserts, contains India's richest storehouse of medicinal herbs. Cold deserts of India occur mainly in Lahaul-Spiti regions, upper parts of Chamba and Kinnaur in Himachal Pradesh, Uttarakhand and Ladakh region in Jammu and Kashmir. The thorn plant naturalizes during snowfall period in upper Himalays. In Himachal Pradesh, it is locally known as 'Chharma' and grows wild in Lahaul-Spiti and upper parts of Kinnaur. The plant is a shrub that produces an orange-yellow coloured edible berry. The berry has a sour taste, but is rich in vitamins, especially vitamin C, E and K. This thorn plant contains various bioactive elements including vitamins, carotenoids, flavonoids, phenolic acids, flavones and fatty acids etc. These components have a wide range of health benefits due to their antioxidant, anti-inflammatory, anti-cancer and antimicrobial properties. In addition, the thorn plant is a soil-binding plant that helps preserve floral diversification and stops river siltation and soil erosion.

Keywords: *Bioactive compounds, Nutraceutical, Antioxidant, income generation, Nitrogen fixation and traditional uses of medicinal plant Sea buckthorn.*

Introduction

Tibetans utilize ripe fruit of this thorn plant extensively as medicine. The lanceolate leaves of this deciduous shrub is marked by their abundance of thorns and their frequent arrangement in opposite pairs. The plant is a pioneering species of tree for improving soil, reducing wind and sand, and conserving water and soil. The Sea buckthorn Association of India estimates that this plant covers over 15,000 hectares of land in Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh. There are numerous ecological, medicinal and economic benefits associated with the sea buckthorn plantation. Fruits, leaves, stems, branches, roots, and thorns- are all parts of this plant that have historically been utilized in medicine, as dietary supplements, for preserving soil and moisture, and to provide habitats for wildlife. Sea buckthorn is a plant of significant ecological and commercial value. The International Sea Buckthorn Association (ISA) was founded in 1999 by China, India, Canada, and other nations to promote the benefits of sea buckthorn for human health, economic development, and environmental conservation. The medicinal benefits of sea buckthorn have become more widely known in recent years, and numerous nations are starting to acknowledge and establish a sea buckthorn business.

Morphology

Seabuckthorn is a member of the Elaegnaceae family, which is the largest group of flowering plants. In general, it is 1–8 m high. The lanceolate or linear leaves typically measure 3-8 cm in length and 7 mm in width. The leaves have a distinguishing silver-gray lower surface and a dark grey upper surface. The fruits are 8 mm in diameter and are spherical or ovate in shape. Usually, a number of fruits with ruffled surfaces and an orange-yellow or brownish-red tint are pressed

***Corresponding Author:**
Kamlesh Kumari;
DOI: http://dx.doi.org/10.21746/aps.2024.13.11.4

together. The pulp has a soft texture and is greasy. The sea buckthorn seed is obliquely oval, measuring around 4 mm in length and 2 mm in width. The seeds have a longitudinal groove in the middle and are lustrous brown [Figure 1].

Bioactive Compounds

Rats treated with standardized doses of Sea buckthorn pulp oil and seed oil had a strong cardioprotective effect against myocardial injury, according to biochemical and physiological studies conducted by AIIMS, New Delhi. Rich in vitamins, minerals and crude protein, Sea buckthorn leaves and fruit waste create high-quality feed for poultry and dairy animals. Nearly 200 minerals and bioactive components can be found in sea buckthorn. Numerous ingredients are well known for their beneficial effects on health. One of the most vital nutrients in sea buckthorn is vitamin C. The primary bioactive and antioxidant components of sea buckthorn are carotenoids and polyphenolic chemicals, particularly phenolic acids and flavonoids (Doijey, 1997). Sea buckthorn's organic acids, minerals, amino acids and phytosterols, all have significant effects. Sea buckthorn's nutritional value is also influenced by its bioactive components and nutrients (Ma, *et al.,* 2022).

A few other vitamins, including folic acid, B1, B2, and K, are also present in berries (Jiang and Sink, 1997). Furthermore, among medicinal plants, Sea buckthorn berries have one of the strongest antioxidant activity due to their high concentration of naturally occurring antioxidants. Ascorbic acid is their main antioxidant, although they also include flavonoids, carotenoids, and tocopherols [Table 1].

Seabuckthorn Oils

It is possible to extract two distinct oils from sea buckthorn: the pulp oil and the seed oil (Zeb, 2006). The oil content of the mature seed's ranges from 8 to 20%, that of the dried fruit pulp (flesh and peel) from 20 to 25%, and that of the berry residue remaining after juice extraction from 15 to 20% (Ercili, *et al.,* 2008). Vitamins E and K, carotenoids, tocopherols, tocotrienols and sterols are all plentiful in these oils (Stobdan, *et al.,* 2013) [Table 2].

Table 1: Antioxidant Composition of Sea Buckthorn Juice

Items	mg/l
Vitamin E	13.5
α-, β-, γ- tocopherols	12.4
α-, β-, γ-tocotrienols	1.1
Vitamin C	1540.0
Carotenoids	7.3
Flavonoids	1182.0

Table 2: Sea buckthorn Seed and Pulp Oils' Chemical Composition

	Seed oil	Pulp oil
Fatty acids (%)		
Palmitic 16:0	6 - 10	15 - 40
Palmitoleic 16:1 n-7	<0.5	15 - 50
Oleic 18:1 n-9	15 - 20	10 - 20
Linoleic 18:2 n-6	35 - 40	5 - 15
α-Linolenic 18:3 n-3	20 - 35	5 - 10
Vitamins (mg / 100 g)		
K	110 - 230	54 - 59
E	207	171
Tocopherols & tocotrienols	100 - 200	100 - 400
Carotenoids	10 - 50	100 - 400
Plant sterols (%)	1 - 2	2 - 3

Traditional Uses

The sea buckthorn's medicinal properties were initially discovered by the Thracians, Hindus, Greeks, Chinese, Mongols, Celts, and Slavs. Sea buckthorn's historical use in traditional ethnobotanical and ethnopharmacological applications of plant species was first recorded by Ayurvedic physicians Theophrastus and Dioscorides, who suggested feeding sea buckthorn to race horses to help them gain muscle mass (Ashour, *et al.,* 1995). The people who live in the trans-Himalayan region historically utilized every component of the plant for a variety of reasons, including building construction, ceremonies related to religion, medicine, nutritional supplements, fuel, fencing, tree guards, wind breaks and agricultural tools. Because sea buckthorn is short in supply, it has been traditionally used for many reasons. Sea buckthorn is also known as the "Wonder Plant," "Ladakh Gold," "Golden Bush," or "Gold Mine" of frigid deserts because all parts of the plant including fruit, leaf, twig, root, and thorns have been utilized.

In the Tibetan medical system, known as **'Sowa Rigpa',** 'Amchi' system of medicine, which is practiced in Ladakh, Lahul-Spiti and the Kinnaur valley of the Himalayas, there are more than a hundred well-known formulations based on sea buckthorn (Jike and Xiaoming, 1992). Despite the plant's significance in people's lives, the traditional knowledge of its uses is gradually vanishing as a result of the region's openness to the outside world and the availability of substitutes from other continents. Even now, Amchis, (local practitioner doctor) in the Himalayas, frequently recommends remedies made from thorn plants fruit, seed, root, etc. to cure common issues like gastric ulcers, wound healing, blood purification, etc. The berries that have been macerated are used as a remedy to stop lip splitting in the dry, cold weather. Fruits are utilized as a tonic for expectant mothers, PCOD patients and undernourished youngsters.

Applications in Food

Sea buckthorn is being used in an increasing number of food products, including oil, berry powder, seed oil capsules, fruit juice, wine, milk tablets, fruit vinegar beverages, green tea, preserved fruit, yogurt, jam, and so on (Gupta and Singh, 2003).

Nitrogen Fixation

Because of the Frankia-actinorhizal symbiosis in its root nodules, it has an exceptional capacity to fix atmospheric nitrogen and contributes around 180 kg of nitrogen per hectare annually to the soil (Ji, *et al.,* 2020). By forming a symbiotic relationship with rhizobia, sea buckthorn's root nodules are able to fix nitrogen, which transforms atmospheric nitrogen into ammonia that plants can use as a growth source. An additional benefit of the plant's deep and extensively branching root structure is that it acts as a soil-binder, preventing soil erosion, controlling river siltation, and promoting floral diversification. It has been used in India to grow on sand dunes and beside rivers to prevent soil erosion brought on by wind and water (Jiang and Sink, 1997).

This resilient shrub is an excellent substitute for willow trees, which are rapidly dying in the Lahaul valley as a result of pest infestation. It also helps to preserve the local environment. It thrives in arid climates and gains significant importance, particularly with the reduction in water flow from the Himalayan glaciers.

1D

Income Generation

Since 2001, gathering sea buckthorn berries has increased in importance as a source of revenue in the Himalayan region. Sea buckthorn farming helps underprivileged rural people by providing income while also preventing desertification, which is good for the ecology. The majority of berry pickers come from indigenous women and the poor segments of the society in these high-altitude areas of Lahul-Spiti and Ladhakh [Figure1]. Nevertheless, large-scale cultivation of the plant is required because wild sea buckthorn cannot provide the industry with raw

materials in a sustainable manner. With the development of technology by the Defence Institute of High-Altitude Research (DRDO) to prepare a beverage from the fruit of sea buckthorn plant, it has gained more attention in India. The technology has been positively embraced by industry leaders, and ready-to-serve beverage products bearing the names "Leh Berry," "Ladakh Berry," "Power Berry," are presently offered in the Indian market. Consumers have responded favourably to herbal tea made from Himalayan herbs. A number of other products are in varying phases of development and commercialization, including a sea buckthorn oil soft gel capsule, pickle, jam, beverage and an antioxidant herbal supplement Figure 2 (Ma, *et al.,* 2022).

Fig. 1: Local tribal women's of Lahul-Spiti collecting Sea buckthorn berry and leave

Fig. 2: Products made from sea buckthorn available in the market

Use as Fodder, Fuel and Fencing

The thorn plant is used for a variety of purposes in Himalayas, including fencing, fuel, fodder, medicinal and improving soil fertility (Wang, *et al.,* 2011). Sea buckthorn foliage is incredibly high in minerals, lipids, and protein (Annonymous, 2003). It has been discovered to increase goat weight gain, chicken egg laying, cow milk supply and a common material for orchard fencing (Wang, *et al.,* 2021). It is well recognized that planting Sea buckthorn for fencing around agricultural fields increases soil fertility. To increase soil fertility in the hills, earth from heavily populated Sea buckthorn areas is frequently blended with soil from low-fertile fields. Because there isn't much land that can be farmed in the area, agricultural areas are the most valuable. In order to deter stray animals and pedestrian traffic, the dense, prickly bush is typically planted around agricultural fields and plantation areas. Additionally, the dried branches and twigs are placed around the boundaries of fields and residential buildings.

In open spaces, Sea buckthorn windbreaks are a useful tool for reducing wind erosion. It is an excellent choice for windbreak plants since it can withstand the physical harm and drying effects of wind (Ashour, *et al.,* 1995 and Bhagat, *et al.,* 2003). A common issue in cold deserts is a shortage of firewood (Bal, *et al.,* 2011). On the one hand, because of the chilly climate, fuel wood is needed to keep homes warm during the winter. But simultaneously, because of the combined forest cover, there is a significant problem with the availability of wood for firewood. Sea buckthorn branches and stems are utilized as firewood in these situations (Teleszko, *et al.,* 2015). The majority of monasteries in Himalayas (Buddhist populated areas) keep up their own sea buckthorn plantations to guarantee a steady supply of firewood. The tough stem of the

plant is frequently used as a handle for farming tools (Stobdan, *et al.,* 2008).

Products Based on Sea Buckthorn

Sea buckthorn berries and leaves are used to make a wide range of products for medical, cosmetic, and nutraceutical uses (Stobdan, *et al.,* 2010). Since the early 1990s, the Defence Institute of High-Altitude Research (DIHAR) has been researching SBT and has created a number of products such herbal tea and beverages.

Defence Institute of High-Altitude Research (DIHAR), has created a method for making drinks and the copyrighted method has been given to a number of Indian NGOs, small business owners, and commercial enterprises. The Indian army's special ration, which is carried at higher altitudes, includes berries because of its therapeutic and immune booster qualities (Xing, *et al.,* 2002). Semi-ripe fruits have been used for preparing pickle and jams (Bartish, *et al.,* 2000) [Figure 2].

Conclusion

Because of the health, nutritional, and environmental advantages of sea buckthorn, the plant's future seems bright. Its potential in medicines, nutraceuticals, and functional foods is still being investigated. Consequently, this opens up opportunities for more detailed investigations into how they work and their possible uses in medicines. The plants' ability to thrive in challenging environments, its versatility in application, and its valuable nutritional composition make it an attractive option for sustainable agriculture.

To sum up, Sea buckthorn has a long history, a fantastic nutritional profile, and a host of health advantages. Its cultivation, medicinal applications and usage in various industries make it a plant of great importance. As research and awareness continue to grow, Sea buckthorn's potential will likely be further explored, leading to new discoveries and applications for this wonderful plant.

Acknowledgment

The authors would like to thank the Department of Botany, Daulat Ram College, and University of Delhi for the research facilities provided.

Authors Contributions

Both the authors contributed for writing this research paper. Kamlesh Kumari: Literature review, data collection and writing original draft; Remya Krishnan: Final reviewing, editing and approval for publication.

References

1. Annonymous. Annual Report-2992. Field Research Laboratory (DRDO)-Leh (Ladakh) (2003).
2. Ashour, A. A., Taha, H. A. & Muhammad, A. E. H. "Comparative SDS-PAGE protein patterns of four ascarid nematodes." *Journal of the Egyptian Society of Parasitology* 25.3 (1995): 761-767.
3. Bal, L. M., Venkatesh, M., Naik, S. N. & Santosh, S. "Seabuckthorn berries: A potential source of valuable nutrients for nutraceuticals and cosmeceuticals." *Food Research International* 44.6 (2011): 1718-1727.
4. Bartish, I. V., N. Jeppsson. & Bartish, G. I. "Inter- and intraspecific genetic variation in *Hippophae* (*Elaeagnaceae*) investigated by RAPD markers." *Plant Systematics and Evolution* 225.1 (2000): 85-101.
5. Bhagat, R. M., Kahsyap, N. P. & Virender, S. "Insect-pests associated with seabuckthorn (*Hippophae rhamnoides*)." *Pest Management and Economic Zoology* 14.1 (2003): 191-193.
6. Brad, I., Brad, I. L. & Radu, F. "Sea buckthorn: A pharmacy in a plant." *Technical Publishing House, Bucharest, Romania* (2000).
7. Doijey, T. "Seabuckthorn: A new direction towards eco-development in Ladakh." *Ladakh Ecological Development Group*, Leh (Ladakh), J & K, India (1997).
8. Ercili, S., Emine, O., Nalan, Y. and Güleray, A. "Comparison of seabuckthorn genotypes (*Hippophae rhamnoides* L.) based on RAPD and FAME data." *Turkish Journal of Agriculture and Forestry* 32.4 (2008): 363-368.
9. Gupta, R. K. & Virendra, S. "Harvesting technologies of seabuckthorn fruits." In:

Seabuckthorn: A Multipurpose Wonder Plant, edited by V. Singh et al., Indus Publishing Company, 1 (2003): 47-63.
10. Jiang, C. & Kenneth, C. S. "RAPD and SCAR markers linked to the sex expression locus M in asparagus." *Euphytica* 94.3 (1997): 329-333.
11. Ji, M., Xue, G., Xue, L., Congcong, W. and Minhui, L. "Advanced research on the antioxidant activity and mechanism of polyphenols from *Hippophae* species—A review." *Molecules* 25.4 (2020): 917.
12. Jike, Z. & Z. Xiaoming. "Progress on study on *Frankia* in nodules of seabuckthorn." *Hippophae* 2.1 (1992): 4-10.
13. Kumar, R., Kumar, G. P., Chaurasia, O. P. & Singh, S. B. "Phytochemical and pharmacological profile of seabuckthorn oil: A review." *Research Journal of Medicinal Plant* 5.5 (2011): 491-499.
14. Ma, C., L. Du. & G. Cai. "Investigation and research on the distribution of seabuckthorn germplasm resources in Changji Prefecture." *Modern Agriculture Science and Technology* 1 (2022): 139-141.
15. Negi, J. P., Khosla, P. K., Kaushal, P. S., Sankhyan, H. P. & Singh, R. P. "Eco-development impact and evaluation of the Desert Development Programme in the cold desert of Spiti, Himachal Pradesh, India." (1978): 108 pp.
16. Rongsen, L. U. "Seabuckthorn: A multipurpose plant for fragile mountains." *ICIMOD*, Kathmandu, Nepal (1992): 62.
17. Stobdan, T., Konchok, T., Deachen, L. and Ravi, B. S. "Judicious use of natural resources: A case study of traditional uses of seabuckthorn (*Hippophae rhamnoides* L.) in trans-Himalayan Ladakh, India." *National Academy Science Letters* 36.6 (2013): 609-613.
18. Stobdan, T. "Seabuckthorn plantation for sustainable development of trans-Himalayan Ladakh." In: *Defence Technology Spectrum*. Defence Research and Development Organisation, Ministry of Defence, India (2016): 141-144.
19. Stobdan, T., Chaurasia, O. P., Yadav, A. & Singh, S. B. "Seabuckthorn (*Hippophae rhamnoides* L.): A wild shrub of defence and societal importance in cold arid high altitude." In: *In Service of the Soldier: Life Sciences Perspective,* edited by Manas K. Mandal, K. Ramachandran, and A. Gupta. Macmillan Publishers India Ltd. (2008): 388-401.
20. Stobdan, T., Chaurasia, O. P., Korekar, G., Mundra, S., Ali, Z., Yadav, A, et al. "Attributes of seabuckthorn (*Hippophae rhamnoides* L.) to meet nutritional requirements in high altitude." *Defence Science Journal* 60.2 (2010): 226-230.
21. Teleszko, M., Wojdyło, A., Rudzinska, M., Oszmianski, J. & Golis, T. "Analysis of lipophilic and hydrophilic bioactive compound content in seabuckthorn (*Hippophae rhamnoides* L.) berries." *Journal of Agricultural and Food Chemistry* 63.10 (2015): 4120-4129.
22. Wang, B., Lan, L., Qing, N. and C. Lian, S. "*Hippophae rhamnoides* Linn. for treatment of diabetes mellitus: A review." *Journal of Medicinal Plants Research* 5.12 (2011): 2599-2607.
23. Wang, K., Zhenzhen, X. and Xiaojun, L. "Bioactive compounds, health benefits, and functional food products of seabuckthorn: A review." *Critical Reviews in Food Science and Nutrition* (2021): 1-22.
24. Xing, J., Baoru, Y., Yaling, D., Bingwen, W., Junxian, W. and Heikki, P. K. "Effects of seabuckthorn (*Hippophae rhamnoides* L.) seed and pulp oils on experimental models of gastric ulcer in rats." *Fitoterapia* 73.7 (2002): 644-650.
25. Zeb, A. "Anticarcinogenic potential of lipids from *Hippophae*—Evidence from the recent literature." *Asian Pacific Journal of Cancer Prevention* 7.1 (2006): 32-34.

Source of support: Nil;
Conflict of interest: The authors declare no conflict of interests.

Cite this article as:
Kumari, K. and Remya, K. "Pharmacological Significance and Curative Potential of Seabuckthorn-A Traditional Tibetan Medicinal Plant in Cold Desert Himalayas." *Annals of Plant Sciences.*13.11 (2024): pp. 6603-6609.