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Seabuckthorn (*Hippophae* sp.): A Unique high altitude multipurpose plant species growing in cold regions

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ABSTRACT

Seabuckthorn (Hippophae L., Elaeagnaceae) is an economically and ecologically important medicinal plant comprising of species which are winter hardy, dioecious, wind-pollinated multipurpose shrubs bearing yellow or orange berries with nitrogen-fixing ability. It grows widely in cold regions of Indian Himalayas, China, Russia, Europe and many other countries and has 7 species and 11 subspecies. It is one of the most important under exploited fruit crops of the high altitude cold arid zones which has immense industrial, medicinal, cosmetic and nutraceutical value. It is commonly known as 'cold desert gold' due to its high potential as a bio-resource for land reclamation, reducing soil erosion and its multifarious uses. The plant is widely used in different countries to obtain different valuable products viz., oil, wine, medicinal supplements and other products. Besides, industrial use, it is one of the important plants of the fragile ecosystem of the cold desert sand and has immense socio-economic and medicinal importance. Sea-buckthorn is well-liked due to its high nutritional values in the berries. The fruit contains 60-80% juice rich in sugar, organic acids, amino acids and vitamins. Vitamin C content is 200-1500 mg 100 g^{-1} which is five to hundred times more than any other fruit or vegetable known. So the sea-buckthorn fruit is being used as a raw material for producing food, medicines and cosmetics. In addition, the sea-buckthorn plant is a good source of firewood and the leaves of sea-buckthorn are good for forage. They have also high soil binding capacity, providing quick surface cover, fixing nitrogen and tolerate of drought and cold.

Keywords: Distribution, Medicinal plant, Nitrogen fixation, Seabuckthorn, Socio-economic importance,

I INTRODUCTION

Seabuckthorn, found in the frozen heights of the Himalaya, is a deciduous, thorny plant species native to Europe and Asia. It is a pioneer species and prefers to grow in low humid, alluvial soils, wet lands and riverside with brown rusty-scaly shoots [18] and sub-tropical zone of Asia at high altitude ranging from a few meters to 5200 meters [24]. The plant is hard, drought and usually cold tolerant, useful for the land reclamation and farmstead protection [35]. It is a multipurpose fast growing species which is serving as a measure of biodiversity conservation, soil conservation, medicines, food, fodder and fuel wood. It has surprising capacity to grow and survive under unfavourable conditions (-40 to 40º C) and has extensive subterranean rooting system with strong soil binding capacity useful for soil fertilization, river bank control and water retention [32]. Seabuckthorn fruit is a very rich source of vitamins and is called treasure of bio-activity substance as it is having over 190 bio-activity substances possessing unique medicinal properties for such reasons it is called wonderful plant [18, 20]. Sea-buckthorn is well-liked due to its high nutritional values in the berries. The fruit contains 60-80% juice rich in sugar, organic acids, amino acids and vitamins. Vitamins C contents is 200-1500 mg 100 g^{-1} which is five to hundred times more than any other fruit or vegetable known (Ahmad and Kamal, 2002). So the sea-buckthorn fruit is being used as a raw material for producing food, medicines and cosmetics. In addition, the sea-buckthorn plant is a good source of firewood and the leaves of sea-buckthorn are good for forage, they have also high soil binding capacity, providing quick surface cover, fixing nitrogen and tolerate of drought and cold. In addition, these plants should have a significant value as fodder, food, fuel and medicinal plants, which are particularly favoured by the farmers [25].

Seabuckthorn offers the opportunity to maintain a sustainable livelihood for the people living in the mountains, providing healthy foods, variety of medicines and protecting their land from soil erosion [3, 18]. The use of seabuckthorn shows how low input costs and watchful planning can lead to fairly substantial benefits, which makes it a good perspective of sustainable development in mountain and qualifies it as a unique option for the synchronized management of several problems emanating from the fragility, nonconformity, isolation and diversity characterising mountain areas [19, 22]. Traditional use of seabuckthorn include fencing of field crops, shielding fruit trees and timber plants, fuel wood production and forage for livestock. However, local people had never thought of planting sea-buckthorn on large scale to play a vital socioeconomic role in the development of poor mountain communities [25].

II. DISTRIBUTION

Many researchers have reported that the genus *Hippophae* has originated from the Himalayan mountain regions and then spread to southwest, northwest and northern China and eastern Inner Mongolia, and then to the northwest regions of Eurasia where from it reached western Alps through the Caspian and Black seas, then finally arriving at the northwest parts (Scandinavian peninsula) and another route progressed towards northwest to reach Mongolia and Siberia via Pakistan, Nepal, Afghanistan, India, China and several Central Asian countries of the former Soviet Union [12, 18, 22]. Seabuckthorn is a typical temperate plant of the Eurasia extensively spread between 27º-69º N latitude and 7º W-122º E longitudes [21, 27]. Its occurrence has been reported in about thirty eight countries (**Table1**), including Afghanistan, Azerbaijan, Belarus, Bhutan, Britain,

Bulgaria, Canada, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, India, Iran, Italy, Kyrgyzstan, Kazakhstan, Latvia, Lithuania, Moldova, Mongolia, Nepal, Netherlands, Hungary, Norway, Pakistan, Poland, Portugal, Romania, Russia, Slovakia, Sweden, Switzerland, Turkey, Ukraine and Uzbekistan. Seabuckthorn is a nitrogen fixing plant. It fixes the atmospheric nitrogen with the help of symbiotic mycorrhizal fungus identified as *Flankia* (Actinomycetes), present in its roots. The estimated capacity of seabuckthorn roots to fix nitrogen is double that of soybean [18, 22]. Apart from fixing nitrogen, the perennial root nodule also helps in function of transforming difficult to dissolve organic and mineral matter into an absorbable state.

Table 1. Distribution and utilization in different countries

Species	Area of Distribution	Status of Utilization
Hippophae rhamnoides Subsp. rhamnoides.	Scandinavian countries, Baltic Sea countries, Germany, Belguim, Netherlands, Ireland, Poland, U.K., France, Russia	Ecological restoration, berries and leaves are processed for various products
Hippophae rhamnoides Subsp. sinensis	China (North, Northwest, Southwest)	Wild resources are used for ecological restorations, while plantations are used to obtain products for pharmaceutical industries
Hippophae rhamnoides Subsp. yunnanensis	China (Sichuan, Yunan, Tibet)	Wild resources are used for ecological restorations only
Hippophae rhamnoides Sub sp. mongolica	Russia (Siberia), Mongolia, China (Xinjiang)	More than 60 varieties cultivated in Russia, exploited to obtain various food and beverage products
Hippophae rhamnoides Sub sp.turkestanica	India, Pakistan, Afghanistan, Turkmenistan, Kyrgyzstan, Uzbekistan, Kazakhstan, China	Wild resources are used for ecological restoration and berries are processed for various products on commercial level for the production of food, medicine and cosmetics
Hippophae rhamnoides Subsp.fluviatilis	Germany, France, Switzerland, Austria, Czech, Slovakia, Italy	Most of wild resources are protected as forest species. Some berries are used for processing products and pharmaceutical's
Hippophae rhamnoides Subsp.carpatica	The Carpathinan Mountains, Transsylvanian Alps, the valley and the mouths of the Donube and its tributary	Ecological restoration, Some varieties are cultivated for processing products
Hippophae rhamnoides Subsp. caucasica	Georgia, Azerbaijan, Armenia, Ukraine, Romania, Turkey, Bulgaria, Russia	Some selected varieties are cultivated for medicinal products
Hippophae. goniocarpa	China (Sichuan, Qinghai)	Ecological restorations, no commercial exploitation reported so far
Hippophae litangensis	China (Sichuan, Qinghai)	Most of wild resources are protected as forest species.
Hippophae neurocarpa	China (Sichuan, Qinghai, Gansu)	Most of wild resources are protected

		as forest species.
Hippophae neurocarpa Subsp. stellatopilosa	China(Sichuan, Qinghai, Tibet)	Protected and used for rehabilitation of degraded areas
Hippophae tibetana	China (Sichuan, Qinghai, Tibet)	Protected as grassland species.
Hippophae gyantsensis	China (Tibet)	Protected as forest species. Some berries are collected for producing Tibetan medicine
Hippophae salicifolia	China (Tibet) Bhutan, Nepal, India	Protected as forest species. Some berries are collected for producing products

III DISTRIBUTION IN INDIA

In India the species is mainly found in the Himalayan range, of Jammu and Kashmir, Himachal Pradesh, Uttrakhand, Sikkim and Arunachal Pradesh. The species is mostly found in high altitudes and adapted to the harsh climatic and edaphic climates with cooler aspects especially in cold deserts. The species is important source of livelihood for the local inhabitants of these areas. The distribution and the composition of different components and bioactive substances of seabuckthorn in Indian Himalayas are given in Table 2.

Table 2. Distribution of Seabuckthorn in India [5]

Species	Distribution	Growing Altitude (amsl)	Plant height	Flowering Time	Fruit Ripening
Hippophae rhamnoides Sub sp. turkestanica	Ladakh: Indus, Nubra, Suru, Changthang valley H.P: Kukumsaru, Lakauk, Kaza, Tabo, Lahual	1600 – 4200	2 – 6	May	Sep. –Oct.
Hippophae salicifolia	H.P: Lahual U. K: Yamunotri, Kaj, Badrinath, Gori, Harindun, Buddi, Dharma, Bagnitiyar. N. E: Lachen, Lachung, Dormang	2700 – 3700	3 – 10	June	Oct.
Hippophae tibetana	Ladakh: Zanskar H.P: Sangrum, Kibbar, Takcha. U.K: Gomuk, Niti, Ranimani, Brtal, Nelong, Shinla, Milan N.E: North Skikkim	3000 – 5200	0.8 – 1.2	May	Aug – Sep.

IV DESCRIPTION

There are six species (*Hippophae rhamnoides, H. salicifolia, H. tibetiana, H. gonicarpa, H. neurocarpa,* and *H. litangenis*) and 12 subspecies of seabuckthorn are grown over the world. The shrubs reach 0.5-6 m tall, rarely up

to 10 m in height, and typically occur in dry, sandy areas, on hills and hillsides, in valleys and river-beds. The dense and thorny bushes of seabuckthorn are salt tolerant and demand full sunlight for growth. The leaves are a distinct pale silvery-green, lanceolate, 3-8 cm long and less than 7 mm with broad brown or black rough bark and a thick greyish-green crown having the natural life span of about 60 to 70 years. It is dioecious with separate male and female plants Table 2. The male produces brownish flowers which produce wind-distributed pollen [2, 29, 30].

A. FLOWER

Seabuckthorn floral buds are predominantly mixed with vegetative buds and are hardly pure. Floral buds appear in summer or the autumn and usually open in the spring. The male flower buds consist of four to six flowers and female consists of mainly one flower and rarely two or three. The flowering in these precocious plants this may occur in the third year, whereas in certain conditions it may happen in the fifth or sixth year [12, 18]. The pollination predominantly takes places by wind, because both the male and the female flowers have no nectar and they rarely attract bees or other insects.

B. FRUIT

Seabuckthorn bears a unique fruit, which is different from other common berries. Fruit is a combination of an un-split, fleshy, extended calyx tube and an ovary. In other words, the swollen, juicy calyx tube has vital part economic importance. Unlike other fruits fall away from the maternal plants, the seabuckthorn berries remain on the branch for several months which gives the ample time to formers to harvest them. In natural conditions seabuckthorn, fruits can remain on the branches till the following in spring. During this period, generally cold winter, the fruits progressively shrink but don't fall and become the favourite food of animals, especially birds. It has sour taste, sharp lemon flavour and contains 60 to 80% juice rich in amino acids, organic acids, sugar, tannins and vitamins and also contains 3 to 5% of pulp oil and 8 to 18% of seed oil [10]. The berries appear to be an unsurpassed natural source of vitamin A and several other carotenes, vitamin E and several other tocopherols and flavonoids. The vitamin C content of the juice ranges from 300 to 1600 mg per 100 gm of juice (Average 600 mg/100 gm juice) [1, 33].

C. SEED

Seabuckthorn is a single seeded fruit, which is ovate oblong with a length ranges between 4-7 mm, a breadth of 2.5-3.5 mm and thickness of 1.6-2.2 mm. The pulp of the seed is greyish brown or dark brown, leathery and lustrous. The seed is globosely coated with fissures on one side with length 3-4.5 mm long, width of 2.5 to 3 mm and with the thickness of 1.5-2 mm thick with sour taste. Seabuckthorn belongs to the group of thermophilic plants. The ptimum temperature for germination of seed is 24º-26º C [3]. By weight the seed consists of only 10% of the fruit. Major chemical composition of Seabuckthorn seed are fats, protein and carbohydrate. The seed consists of 10 to 20 % of oil depending upon the species of the plant vigour [31]. The seed oil contains 12 %-20 % saturated fatty acids and 88 %-89 % unsaturated fatty acids, particularly Linolenic acid (32.3 %), Linoleic acid (40.8 %) and Oleic acid (15%) [28]. The Other important constituents of the seed oil are gamma and alpha Tocopherol [14]. Vitamins A, E and K present in seed oil are used in various fields of food, drug and cosmetics [4, 33].

D. LEAVES

Leaves are small (3-8 cm long and 0.4-1 cm wide), alternate, linear, lanceolate and covered on the backside with silvery stellate scales that reflect sunshine and reduce moisture loss [18, 22]. Leaves of seabuckthorn are used for the preparation of various products as they contain many nutrients and bioactive substances. The fodder values of seabuckthorn and reported that the crude protein content in the leaves was 21.6 %, Fat content varied from 3.5-4.8 % in *H. Rhamnoides*, while the ash content was 5.1 %, total phenolics content was 12.7 %, out of which 92 % were in the form of hydrolysable tannins [30]. This is very high as compared to other locally available fodder species.

Table 2. Major Constituents of Seabuckthorn

Components	Content	Components	Content
Fruit		Pulp	
Fruits Colour	Yellow, orange to orange red	Oil in fruit pulp	8.44 %
Shape	Round, oval, ovoid	Carotenoid in fruit pulp oil	764 mg/100 gm
Fruit weight	10-16 gm /100 berries;	Vitamin E in fruit pulp oil	255 – 435 mg/100 gm
Fruit juice extraction rate	64 – 75 %	Vitamin C in pulp	780 mg/100 gm
Vitamin C in fruit juice	1161.1 – 1302.5 mg/100 gm	Total sugar	7.17 %
Vitamin A in fruit juice	0.75 mg/100 gm	Organic acid	4.4 %
Carotenoid in fruit juice	7.2 – 7.4 mg/100 gm	Leaves	
Soluble solids in fruit juice	15.92 – 17.66	Total flavone in leaves	876 mg / 100 gm
Carotenoid in fruit residue oil	1570 mg/100 gm	Protein in leaves	17.43 – 24.13 %
Total flavone in fruit juice	365 – 885 mg/100 gm	Seeds	
Total flavone in fresh fruit	354 mg/100 gm	Seed	6.54 %
Protein in fruit	34.6 %	Oil in seed	10.37 – 19.51 %
Total sugar	6.29 %	Vitamin E in seed oil	101.5 – 277.6 mg/100 gm
Organic acid	4.35 %	Vitamin C in seed	149 mg/100 gm
Sodium	41.28 mg/kg fruit	Protein in seeds 2	1.66 %
Potassium	1499.96 mg/kg fruit	Total sugar	5.84 %
Calcium	383 mg/kg fruit	Carotenoid in seed	3.3 mg/100 gm
Iron	11.68 mg/kg fruit	Organic acid	0.94 %
Magnesium	47.7 mg/kg fruit	Saturated fatty acid	12 – 20 %
Zinc	0.94 mg/kg fruit	Unsaturated fatty acid	88.3 – 89.1 %
Phosphorus	0.02 %	Linolenic acid	32.3 %
		Linoleic acid	40.8 %
		Oleic acid	15%
Sources: [13, 28, 19, 7, 8, 12]			

E. WOOD/STEM

Seabuckthorn is mostly grows in the form of shrub and rarely a tree. It is hard, woody, erect, perennial, spiny, multiparous, cylindrical and waxy at young stage. The young stem is generally shinning white and soft in nature covered with white scales and multi-cellular hairs, which disappear at later stage. Secondary growth starts in first year and then stops, so it is very hard to find out a stem without secondary growth, so every branch of the stem turns into a thorn [8]. Seabuckthorn, as is a highly thorny plant as the name indicates. Thorns are very stiff

and multifaceted arising as appendages from stem. Each branch of the stem turns into a thorn which are highly cutinaceous with a waxy surface covered with white and brownish scales. The thorn intensity has been found ranging between 1-5 thorns/cm^2 [8].

F. ROOTS

Seabuckthorn has a strong and well-developed tap root system, having primary, secondary and tertiary roots covered with root hairs, found more prominently in the apical portion [22, 8]. About 80% of its primary (feeding) roots are in the surface soil (0.2 to 0.8 m) which helps in preventing erosion [22, 18, 23]. Young plants have often the root twice the height of the plant and widths three times more than the crown of the plant above the ground. The seabuckthorn root system is such extensive that its roots can branch various times in a growing season and form a complex network. Horizontal roots also have root underground buds (turions) which sprout and give rise to another plant (succours). This type of heavy root system enables the seabuckthorn with it high soil binding capacity to play key role in protecting riverbanks, preventing floods and clogging mud.

V USES

Due to its immense use, it has rightly been called a wonderful plant, magic plant, super food, functional food and bank of vitamins. The use of seabuckthorn has a very long history, especially on the Tibetan Plateau. Seabuckthorn has been shown to have a potent antioxidant activity, mainly attributed to its flavonoids and vitamin C content. There are five areas of research that have been focal points for their use: as an aid to patients undergoing cancer therapy; a long-term therapy for reduction of cardiovascular risk factors; treatment of gastrointestinal ulcers; internal and topical therapy for a variety of skin disorders (atopic dermatitis) and as a liver protective agent (for chemical toxins) and a remedy for liver cirrhosis [34]. Other applications of seabuckthorn are treating burns and healing wounds, scalds, ulcerations, and infections, promoting regeneration of tissues, benefiting the hair [15].

A. CONSUMER PRODUCTS

Seabuckthorn (*H. rhamnoides* L.) is one of the most important under exploited fruit crops of the high altitude cold arid zones which has immense industrial importance because of its medicinal, cosmetic and nutraceutical value. The small sized fruits are highly perishable and cannot be consumed fresh due to their highly acidic taste. It therefore, becomes imperative to develop processing procedures in order to ensure its scientific utilization for developing food products. In general, seabuckthorn berries are used for the preparation of juices (condensed juice, syrup juice, mixed juice, health protection juice, carbonated juice); hard drinks (sweet, medium, dry, carbonated wines, champagne and beer); jams, squash, juice powder, seabuckthorn pickle, sweets, chocolates tea, sauce and oil (pulp, seed and residue oil), blended products like drinks, mixed fruit jam, jelly [8, 11].

B. ECOLOGICAL USES

Due to its unique biological features, seabuckthorn has been used in various ways to maintain the ecology of the Himalaya. Strong root systems and the ability to propagating itself: A five-year plant has a taproot of 3 m and horizontal roots of 6 to 10 m [18]. Three year old plants can produce10 to 20 new generation plants by root turions [10]. Nitrogen-fixing capacity: An 8 to 10-year old seabuckthorn orchard can fix 180 kg of

nitrogen/ha/year [18]. Biomass production ability: A 6-year old seabuckthorn plantation can produce 18 tons of fuel wood. The heat value of seabuckthorn wood is 4785.5 cal/kg [18]. One ton of seabuckthorn wood is equal to 0.68 ton of standard coal. Water and soil loss controlling ability: Compared to wasteland, 7-year old seabuckthorn orchard can reduce 99% of runoff and 96% of soil loss. Soil fertility improving ability: Seabuckthorn is pioneer plant within a fragile and marginal context and forest can greatly increase the contents of nitrogen, phosphorus and organic matter in the soil. Ability to promote the growth of plant species: When pine and poplar were planted with seabuckthorn in mixed forests, it was found that seabuckthorn greatly promoted better growth of pine and poplar [10].

As Maintaining Ecological Balance: It has been observed that a number of wildlife species depend on seabuckthorn stems, leaves, flowers, roots, fruit and seed. In the Loess Plateau of China, 51 bird species are entirely dependent and 80bird species are relatively dependent on seabuckthorn for their food [9]. In winter, the importance of seabuckthorn increases as it is almost the only food available for birds. Seabuckthorn provides long-term benefits in terms of maintaining the ecological equilibrium and improving the environment.

C. SOCIO-ECONOMIC USES

As food industry: At present, many factories are producing seabuckthorn food, beverages and other products such as jam, jelly, juices and syrup. Along with traditional foods, some new ones, such as condensed juice, mixed juice, seabuckthorn carrot jam, candied fruit, seabuckthorn cheese, seabuckthorn butter, tea and health protection drinks are also being produced.

1. As a food additive: The pigments of seabuckthorn are widely used as a food additive. Seabuckthorn yellow consists of flavours, carotene and vitamin E. Its physio-chemical properties, such as appearance, solubility, color value, heat and light stability and effect of pH and metabolic ions make it a very useful food additive.
2. As fuel wood: In the Hindu-Kush Himalaya region, plant biomass is the most important source of energy. Seabuckthorn has proved to be a popular green energy plant because of its quality biomass. It is a good source of firewood.
3. As medicine: About ten varieties of seabuckthorn drugs have been developed and are available in the form of liquid, powder, plaster, paste, pills, liniments, aerosols, etc. These drugs are used for treating burns, gastric ulcers, chilblains, scales, oral mucosities, rectal mucosities, cervical erosion, radiation damage and skin ulcers caused by malnutrition and other damage relating to the skin. The most important pharmacological function of seabuckthorn oil is in diminishing inflammation, disinfecting bacteria, relieving pain and promoting regeneration of tissue.
4. Seabuckthorn has been shown to have a potent antioxidant activity, mainly attributed to its flavonoids and vitamin C content [26]. Both the flavonoids and the oils from seabuckthorn have several potential applications [14]. Many health claims are associated with seabuckthorn. The berries seem to have preventive effects against, cardiovascular diseases, mucosa injuries, skin problems, cancer and immune system support. External uses of seabuckthorn include treating a wide variety of skin damage, including burns, bedsores, eczema and radiation injury.

5. Cosmetics: Many kinds of seabuckthorn cosmetics have been developed and tested in hospitals. It is proved that seabuckthorn beauty cream has positive therapeutic effects on melanosis, skin wrinkles, keratoderma, keratosis, senile plaque, xeroderma, facial acne, recurrent dermatitis, chemical corrosion and inchthyosis, as well as freckles. Other seabuckthorn extracts can improve metabolism and retard skin maturation. Seabuckthorn has been shown to have additional health benefits for the liver, including treating liver fibrosis and providing a protective effect for liver injury.

VI. ROLE IN THE ECONOMY OF LADAKH REGION

Ladakh is a region in the northern part of India in western Himalayas, bordering the Tibet. Situated in the the Great Himalayan range, it is a cold desert with the high altitude, with an extremely harsh environment both for humans and most life form. The people of Ladakh importantly use Seabuckthorn as fuel, fodder for livestock and as a live fence for their fields. That the fruits are not consumed since they are very sour. It imporves soil nutrient quality by enhancing organic carbon and nitrogen levels and also acts as a soil binder. This is possible because of its extensive root system and checks soil erosion due to high velocity winds and water. Since it is a very hardy plan it has been used in greening program which are much need in order to enhance the oxygen levels in high altitude areas.

Herbal beverages are been made from Seabuckthorn by both local organisations and the Defence Research and develpement organisations (DRDO). The beverage preserves all its nutrient qualities unless heated, even at sub-zero temperatures (-20°C). It is used by Indian Army during winters. The fruit is a rich source of Vitamin A, B_1, B_2, E and K and a very rich source of Vitamin C. It also contains proteins, Organic acids, Carotenoids, Flavanoids and minerals like iron, cobalt, molybdenum etc are also present in significant quantities [6, 16, 17]. Tsestalulu (Seabuckthorn) has been conventionally been used by Amchi (doctors) in the region. It was also used as a home remedy for diseases like coughs and cold, headaches and constipation. Leh Nutrition Project (LNP) a local NGO has used locally made Seabuckthorn juice as a nutritious supplement for patients of scurvy in the distant areas of Chanthang. In 1992, the then director of FRL (Field Research Laboratory, Leh, DRDO), made efforts for greening the area by using Seabuckthorn. The timeline of the Seabuckthorn sector in Ladakh region follows.

A. SEABUCKTHORN JUICE CONCENTRATE

Seabuckthorn berry is a very small but a very juicy fruit and a very rich source of vitamin E and vitamin C which makes it a very strong antioxidant and immunity booster. Hence the juice is used in making health drinks and anti-tumor creams. The juice is made by adding seven parts of water to one part of juice. The brands currently available in the market are Leh-Berry and Kohinoor fruit juices of FIL industries in the Indian market.

B. SEABUCKTHORN BERRY OIL AND SEED OIL

Seabuckthorn berry pulp consists of nearly 20-25% of oil. The mature seeds of *H. rhamnoides* contain 8-20% oil in contrast to the pulp of the berry. The oil has medicinal and nutritive properties and is suitable for use in medicine and cosmetics.

C. ECONOMIC POTENTIAL

Seabuckthorn has immense potential in the cold desert regions of India. The total area under seabuckthorn in Ladakh is 11, 500 ha (FRL, 2010). The cost of 1kg berries is Rs. 30 in 2012 and cost of pulp is Rs. 85. 1 hectare of stand can provide 750–1,500 kg of berries per year. Average yield from a mature plant is around 500 -2,000 gm (max. of up to 4 kg/plant). The economic analysis based on the data above shows that it has economic potential of around sixty nine crore six lakh twenty five. According to Himachal Pradesh horticultural board potential area that can be brought under seabuckthorn in HP and J&K is around 1, 26,40,000 ha. This shows the immense possibility and economic growth potential of seabuckthorn industry.

VII CONCLUSION

With a forest cover of just 0.6 per cent of total geographical area seabuckthorn has immense potential for greening the cold regions. It can be used to develop beverages and nutraceutical products, cosmetics, pharmaceutical products and preparation of low cost vitamin tablets. The plant has extending properties by way of soil binding capacity, providing quick surface cover, fixing nitrogen and tolerate of drought and cold. The plant has a great potential to enhance the overall socio-economic position of the people in a particular region. The stress should be given for further research and superior equipments like dispensation units at different locations, so that large number of products can be obtained from this value cold desert gold.

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