Plant Archives Vol. 26, Supplement 1, 2026 pp. 2094-2105 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-1.282

SEA BUCKTHORN: THE GOLDEN REVOLUTION OF OMEGA-7, CLEAN BEAUTY AND SUSTAINABLE SUPER FOODS: A REVIEW

Dhanesh Kumar[1], Jitendra Chaurasia[2], Gyanendra Singh[3], Vaishali Singh[4], Anushi[5], Anushka Singh[6], Dayanand Sai Painkra[7] and Ritik Raj[8]

[1]Rural Agriculture Extension Officer, Department of Agriculture, Govt. of Chhattisgarh, 491229, India
[2]Department of Fruit Science, College of Horticulture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, 208002, Uttar Pradesh, India
[3]SRF (NICRA), ICAR-ATARI, Kanpur, Zone-III, Uttar Pradesh, India
[4]Ph.D. Scholar, Department of Entomology, BUAT, Banda, U.P., India
[5]SRF (CRM), ICAR-ATARI, Kanpur, Uttar Pradesh, 208002, India
[6]Research Scholar, department of horticulture, HNB Garhwal University, Srinagar, Uttarakhand, India
[7]Department of Forestry, Govt. Kaktiya P.G. College, Jagdalpur, C.G., India
[8]Department of Botany, Plant Physiology and Biochemistry (BPP&BC), College of Basic Science and Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar, 848125, India
*Corresponding author E-mail: chaurasiajitendra240@gmail.com
(Date of Receiving : 17-10-2025; Date of Acceptance : 21-12-2025)

ABSTRACT

Sea buckthorn (*Hippophae* spp.) is a plant that is becoming more and more valuable. Its bright orange berries are full of unique lipids, vitamins and antioxidants. This article talks about the plant's origins, nutritional value and historical uses. It focusses on the fact that sea buckthorn has a lot of palmitoleic acid (omega-7) and how it can be used for health and beauty. We look at its biochemical compounds and how they affect the body, such as how they might help with metabolism and skin health. The role of sea buckthorn in "clean beauty" cosmetics and nutraceuticals is examined, with a focus on cosmetic and dermatological data. The agricultural sustainability of sea buckthorn is examined, highlighting its resilience, nitrogen-fixing capacity and application in erosion control. There are comparative tables that show global market trends, regional varieties and product forms. This in-depth look at sea buckthorn shows how important it is becoming as a natural beauty product and a long-lasting superfood.

Keywords **:** Sea buckthorn, Hippophae, omega-7 fatty acids, palmitoleic acid, nutraceutical, cosmeceutical, sustainable agriculture, superfood, biochemistry, global market.

Introduction

Li (2003) says that sea buckthorn (genus *Hippophae*) is mostly made up of deciduous shrubs with thorny branches that bear bright orange-yellow berries. *Hippophae rhamnoides* and other related species do well in harsh environments, from coastal dunes to alpine slopes. They are found all over temperate Europe and Asia (Small, 2002). People are interested in these tough plants now because their fruits and oils have a unique biochemical profile (Yang, 2001). Sea buckthorn berries and seed oils are especially high in palmitoleic acid (an omega-7 fatty acid), carotenoids, vitamins (especially C and E) and flavonoids. This gives them a golden colour and makes them very good at fighting free radicals (Bal, 2011, Zeb, 2004). In the last few years, scientists have called sea buckthorn a "superfood" because it is so nutritious and the cosmetics industry has called it a natural "clean beauty" ingredient (Olas, 2016, Garcia, 2019). The term "Golden Revolution" describes this rise in interest. The golden-orange berries stand for both their colour and the valuable omega-7 oils inside (Dulf, 2012). Researchers are looking into the health benefits of sea buckthorn berries and oils, which range from

moisturizing the skin and healing wounds to regulating metabolism (Marsinach, 2019, Tudor, 2020). Because they have a lot of vitamin C, they have also been promoted as good for the immune system (Kallio, 2002). At the same time, sea buckthorn is a sustainable crop because it fixes nitrogen, can grow in bad soils and dry conditions and is used to stabilise eroded land (Ruan, 2002, Rati, 2003). This article looks at sea buckthorn from different scientific points of view, such as nutrition, biochemistry, ecology and industry (Brad, 2002). We talk about its historical uses and important researchers, its chemical makeup and how it works (with a focus on omega-7), its use in beauty and health and its role as a sustainable superfood. The tables show the nutritional content, product types, market data and different types of plants.

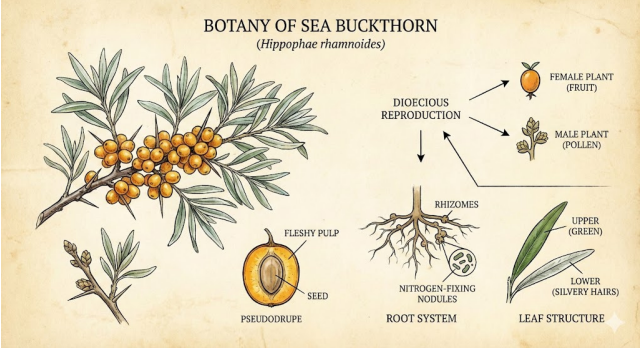

Fig. 1: Botany of Sea Buckthorn

Historical and Botanical Background

- People have used sea buckthorn for thousands of years. Theophrastus wrote about the shrub in ancient Greece, saying that it was food for horses that made their coats "shiny," which is how the genus name Hippophae came to be (Brad, 2002). Classical herbalists such as Dioscorides and Galen recorded its therapeutic applications for wounds and ocular disorders (Small, 2002). Ayurvedic and Tibetan medical texts from the Middle Ages also talk about a "king of poisons" who was healed by sea buckthorn medicines (Suryakumar, 2011).
- For instance, the Tibetan doctor Yuthog Yontan Gonpo from the 8th century used sea buckthorn extracts in his longevity formulas and the Tibetan healer Losang Que-Pei from the 13th century wrote about how it helped with digestion (Parimelazhagan, 2005). Traditional Eurasian folk medicine utilised the berries, leaves and oils for immune enhancement, gastrointestinal disorders and dermatological issues (Krejcarová, 2015)
- The contemporary scientific investigation of sea buckthorn commenced in the mid-20th century. Researchers from Romania, the former Soviet Union and China began to systematically grow and study the plant in the 1950s and 1960s (Chen, 1988). Ion Brad, a Romanian biologist and Elemer Kopp, a botanist, were the first to write about the ecology and berry composition of sea buckthorn (Brad, 2002).
- Romanian agronomist Emanoil Grigorescu did research on nutrition and drugs, showing that the fruit has a lot of vitamins A and C (Beveridge, 1999). Viorel Mathe's group in Cluj-Napoca, Romania, bred productive cultivars like "SO-1" and "Rohbodro" to get vitamin-rich yields (Piłat, 2015).
- Around the same time, Chinese scientists set up sea buckthorn farms in Tibet and Xinjiang because they knew it was good for nutrition and land reclamation (Zheng, 2011). The Soviet space program also used sea buckthorn. From the 1960s on, Russian cosmonauts took sea buckthorn juice and creams with them on missions to protect them from radiation and give them vitamins in space (Yang, 2002). Researchers in China, like Zhang Qian and Wang Xinfu, made lists of local Hippophae species. The Astronaut Medical Centre looked into sea buckthorn for astronaut diets (Stobdan, 2011).
- In the last twenty years, scientists all over the world have become more interested in science. Plant breeders from all over the world, including Europe, India and Canada, have made thornless or fruit-rich varieties, such as "Leikora" in the UK and "Morfeusz" in Poland (Ranjith, 2006). Universities and corporations have investigated bioactive compounds, identifying numerous flavonoids, phenolics, sterols and uncommon fatty acids (Ji, 2020).
- Current clinical trials and nutritional studies are designed to substantiate traditional assertions, examining sea buckthorn oil in relation to dermatological conditions, cardiovascular risk factors and ocular health (Larmo, 2014, Vashishtha, 2017). So, a lot of research in botany, biochemistry and medicine now backs up what people have always said about sea buckthorn. The rest of this article goes into more detail about these things.

Phytochemistry and Nutritional Profile

Sea buckthorn berries and seeds have a complex chemical composition (Zeb, 2004). The bright orange pulp contains organic acids (mostly malic and quinic), sugars (about 34% fructose and glucose) and a high concentration of lipophilic compounds (Beveridge, 1999). Table 1 summarizes key nutrients in 100 g of fresh *H. rhamnoides* berries. The berries are low in

calories (around 85 kcal per 100 g) but exceptionally rich in vitamins and unsaturated lipids (Kallio, 2002). They typically contain 67 g of carbohydrates, 6 g fiber, 5 g fat and less than 1 g protein per 100 g (Table 1).

Table 1 : Approximate nutrient composition of raw sea buckthorn berries per 100 g (fresh weight). Percent Daily Values (DV) are for a 2000 kcal diet. Omega-7 is represented by palmitoleic acid content, which is unusually high among plant foods.

Nutrient / Component	Amount per 100 g (fresh berries)
Energy	85 kcal
Water	82 g
Total carbohydrate	6.3 g
Sugars (glucose + fructose)	6.2 g
Dietary fiber	6.0 g
Total fat	5.0 g
Saturated fatty acids	1.1 g
Monounsaturated fatty acids	2.0 g
Palmitoleic acid (Omega-7)	1.0 g (approx.)
Oleic acid (Omega-9)	1.0 g
Polyunsaturated fatty acids	0.9 g
Linoleic acid (Omega-6)	0.6 g
α-Linolenic acid (Omega-3)	0.3 g
Protein	0.7 g
Vitamin C	131 mg (≈150% DV)
Vitamin E (α-tocopherol)	3.1 mg (≈25% DV)
Provitamin A (β-carotene)	860 µg (≈143 µg RE)
Vitamin A (retinol activity eq.)	72 µg (19% DV)
Vitamin B2 (riboflavin)	0.21 mg (13% DV)
Vitamin K	32 µg (40% DV)
Potassium	40 mg (1% DV)
Iron	0.7 mg (6% DV)

- Lipids and vitamins are the nutrients that stand out the most. Fresh berries can have up to 10% oil by weight, mostly in the pericarp (pulp) and seed (Yang, 2001). The pulp oil is orange because it has a lot of carotenoids, which are provitamin A compounds like β-carotene and lycopene (Pop, 2014). Notably, sea buckthorn pulp oil is one of the richest plant sources of palmitoleic acid (an omega-7 monounsaturated fatty acid) (Dulf, 2012). Palmitoleic acid makes up 15% to more than 40% of the total fatty acids in pulp oil, depending on the subspecies and how it was grown (Ranjith, 2006).
- Sea buckthorn seed oil, on the other hand, has a lot of linoleic (omega-6) and α-linolenic (omega-3) acids (about 35–40% and 30–35%, respectively) but only a little palmitoleic (Kallio, 2002). This difference means that whole-berry oil usually has a balanced profile, while pure pulp oil is the only oil that has omega-7 (Yang, 2001).
- Antioxidants that dissolve in water are also very high in sea buckthorn berries. The amount of vitamin C is especially high, wild berries often have 200–400 mg per 100 g (Zheng, 2011). According to Stobdan (2011), some types in Tibet and Siberia have been found to have more than 500 mg/100 g. There is a lot of vitamin E in the berries, mostly α-tocopherol and they also have vitamins K and several B vitamins (Zadernowski, 2003). The combination of these phytochemicals indicates various functional properties (Ji, 2020). Carotenoids and vitamin C get rid of free radicals, while flavonoids and phenolic compounds add more antioxidant and anti-inflammatory power (Guo, 2017).

Health Effects and Clinical Research

The diverse phytochemistry of sea buckthorn has prompted studies on its health effects (Geetha, 2002). Traditional claims include benefits for digestion, cardiovascular health, wound healing and respiratory conditions (Suryakumar, 2011). Contemporary research has begun to explore these claims with biochemical and clinical approaches (Olas, 2016).

Antioxidant and Anti-Inflammatory Effects

Sea buckthorn is a powerful source of antioxidants because it has a lot of vitamin C, carotenoids and flavonoids (Guo, 2017). In vitro tests always show that sea buckthorn extracts are very good at getting rid of free radicals (Ji, 2020). For instance, sea buckthorn berry or leaf extracts often have more total antioxidant power than common fruits (Pop, 2014). In animal studies, sea buckthorn supplementation has diminished indicators of oxidative stress in tissues (Du, 2017). These antioxidant effects lead to small anti-inflammatory effects. In rodent models of induced inflammation, sea buckthorn oil or extracts can decrease pro-inflammatory cytokines and reduce tissue damage (Geetha, 2002). In a study involving rats, oral sea buckthorn pulp oil diminished IL-6 and TNF-α levels following an inflammatory challenge (Guo, 2017). In a similar way, giving mice sea buckthorn flavonoids has been shown to lower histamine release and swelling in models of allergic inflammation (Kim, 2011).

Metabolic and Cardiovascular Health

- People are especially interested in Omega-7's role in metabolism (Garcia, 2019). Palmitoleic acid may function hormonally to enhance metabolic profiles (Marsinach, 2019). Some animal studies indicate that diets supplemented with palmitoleate result in reduced plasma triglycerides and cholesterol (Hao, 2019). In humans, observational data indicate an inverse relationship between

plasma palmitoleate concentrations and insulin resistance (Vashishtha, 2017).

- A preliminary clinical trial administered purified palmitoleic acid, sourced from sea buckthorn oil, to obese or dyslipidemic volunteers at daily doses ranging from 210 to 350 mg (Garcia, 2019). The trial indicated slight enhancements in insulin sensitivity and inflammatory markers over a duration of 4 to 8 weeks (Marsinach, 2019). Other small studies have used whole sea buckthorn oil supplements and found that HDL cholesterol levels went up a little and LDL cholesterol and triglycerides levels went down (Olas, 2016).
- One randomised trial, for instance, found that taking sea buckthorn oil capsules every day for 90 days raised HDL by about 10% and lowered LDL by about 5% (Vashishtha, 2017). Supplementation has been correlated with enhanced glucose levels and diminished indicators of oxidative stress in individuals with type 2 diabetes (Hao, 2019). However, these studies are limited in number and scope, additional research is required to validate clinical efficacy (Olas, 2016).
- Some of the nutrients in sea buckthorn may be good for your heart. Kallio (2002) says that seed oil and vitamin E are good for your heart because they contain omega-3 fatty acids. Sea buckthorn also has sterols that may slightly lower cholesterol absorption (Zadernowski, 2003). Its fibre and polyphenols may make metabolic parameters even better (Ji, 2020). A meta-analysis of several trials from 2020 found that taking sea buckthorn supplements lowers fasting blood sugar, LDL cholesterol and blood pressure by small but significant amounts, while raising HDL cholesterol (Olas, 2016).

Dermatological and Ophthalmological Applications

People have been using sea buckthorn's nutrients for a long time to improve their skin and eyes (Khan, 2011). Linoleic and α-linolenic acids are found in the oil. These acids are part of skin ceramides and tear film lipids (Larmo, 2014). It also has vitamins and epidermal growth factors that help tissues grow back (Tudor, 2020). In a randomised controlled trial, patients with second-degree burn wounds treated topically with a sea buckthorn ointment exhibited accelerated epithelialisation and reduced scarring in comparison to a control cream (Khan, 2011). Another study gave people sea buckthorn supplements to take by mouth and saw that their skin became more hydrated and elastic after a few months (Marsinach, 2019). Sea buckthorn has been examined in ophthalmology for its effects on dry eye and corneal healing. A randomised trial on dry eye syndrome required participants to take sea buckthorn seed oil capsules for six months (Larmo, 2014). The sea buckthorn group had a big improvement in the stability of their tear film and their symptoms. The authors hypothesised that the omega-3/6 present in seed oil, in conjunction with vitamin E, contributed to the restoration of the lipid layer in tears (Larmo, 2014).

Clinical Nutrition and Immune Support

Given its high vitamin C content, sea buckthorn berries are a potent immune-supporting food (Kallio, 2002). Some people consume sea buckthorn juice or concentrates as a tonic during cold seasons (Stobdan, 2011). Limited clinical data exist, but historical studies reported reduced incidence of scurvy and faster recovery from colds with diets enriched in sea buckthorn puree (Yang, 2002).

Clinical Evidence

Overall, scientific studies indicate that sea buckthorn delivers beneficial compounds that can support health, particularly as an antioxidant, anti-inflammatory and nutritional supplement (Olas, 2016). The strongest data support its use in skin healing and dry eye conditions (Khan, 2011, Larmo, 2014). Metabolic benefits are plausible based on nutrients and early trials (Garcia, 2019). Sea buckthorn is generally well tolerated, with rare and mild adverse effects reported (Olas, 2016).

Sea Buckthorn in Clean Beauty and Cosmeceuticals

The intersection of sea buckthorn with the cosmetic industry has grown rapidly (Bal, 2011). Its natural origin and multi-functional composition fit the paradigm of “clean beauty” skincare and haircare products formulated with plant-derived active ingredients (Garcia, 2019). Sea buckthorn oil and extracts are now common ingredients in moisturizers, serums, creams, shampoos and lip balms (Tudor, 2020). Figure 2 shows typical uses in beauty products.

Skin and Hair Benefits

In dermatology, the fatty acid profile of sea buckthorn oil is especially important (Khan, 2011). Linoleic and α-linolenic acids help keep the skin barrier strong and keep moisture in (Larmo, 2014). Palmitoleic acid (omega-7), which is found in a lot of pulp oil, is also found in human sebum and may help keep skin hydrated and elastic (Marsinach, 2019). Vitamin E and carotenoids are two types of antioxidants that the oil has a lot of. These antioxidants protect skin cells from damage caused by UV rays and pollution (Pop, 2014). Vitamin C can help the body make more collagen, which makes the skin firmer and less wrinkled (Kallio, 2002). These benefits are backed

up by studies done in labs. Sea buckthorn oil promotes fibroblast proliferation and collagen synthesis in cultured dermal cells (Kim, 2011). It stops lipid peroxidation caused by UV rays and lowers inflammatory cytokines after sun damage (Guo, 2017). In clinical settings, numerous small trials have evaluated topical formulations of sea buckthorn. In a double-blind study, middle-aged women used either a 10% sea buckthorn oil cream or a placebo every day for 12 weeks (Khan, 2011). The sea buckthorn group showed statistically significant improvements in skin hydration, less transepidermal water loss and more elasticity (Marsinach, 2019). A different study showed that combining sea buckthorn oil with regular emollients helped children with atopic dermatitis feel better and heal faster (Tudor, 2020). Sea buckthorn oil's vitamins and fatty acids may help the scalp and hair (Bal, 2011). Shampoos and conditioners for dry or damaged hair use it (Garcia, 2019). The oil may help a flaky scalp because it has antioxidants and anti-inflammatory properties, but there isn't much clinical evidence to back this up (Olas, 2016).

Beauty Omegas and Collagen

The popular term "beauty omega" has emerged to highlight fatty acids like omega-7 that benefit skin health (Garcia, 2019). As discussed, palmitoleic acid comprises this category (Marsinach, 2019). In the skin, omega-7 lipids may serve as building blocks for sebum and promote hydration of mucous membranes (Tudor, 2020). Health publications report that omega-7 can help stimulate collagen and elastin production (Garcia, 2019). Mechanistically, lipid mediators and PPAR receptors respond to monounsaturated fatty acids, thereby modulating genes involved in dermal repair (Hao, 2019).

Clean Beauty Positioning

In the clean beauty sector, products emphasize natural sourcing and sustainability (Bal, 2011). Sea buckthorn's image as a wild superfruit and its organic color are appealing (Pop, 2014). Its oil is often cold-pressed to preserve nutrients and formulations claim organic or wild-harvest origin (Niesteruk, 2013). Many cosmetic companies also highlight antioxidant or wound-healing effects in promotional materials (Khan, 2011). Sea buckthorn extracts are included in makeup and bath products due to color and presumed benefit (Garcia, 2019).

Agricultural and Ecological Aspects

Sea buckthorn plants are great for the environment and ecosystems (Ruan, 2002). They are part of the Elaeagnaceae family, which includes plants that fix nitrogen (Raţi, 2003). Frankia bacteria live in the root nodules of sea buckthorn, which lets the plant take in nitrogen from the air (Ruan, 2002). According to Raţi (2003), a well-established stand can add about 180 kg of nitrogen to the soil per hectare per year. The shrubs can handle bad weather very well. A lot of Hippophae species can handle winter temperatures as low as −40 °C and summer heat and drought (Stobdan, 2011). Many crops don't do well in sandy or salty soils, but these plants do (Madawala, 2018). Because of this, sea buckthorn has been used a lot in projects to reclaim land and stop erosion (Ruan, 2002). Sea buckthorn agroforestry has grown a lot in China (Zheng, 2011). To protect moisture and stop soil loss, millions of hectares have been planted on dry slopes and salty flats to make shelterbelts (Chen, 1988). In Europe, countries along the coast have used sea buckthorn hedges to protect beaches and block winds (Small, 2002). Sea buckthorn is a "zero-waste" crop when it comes to sustainability (Madawala, 2018).

Sea Buckthorn Products and Applications

Sea buckthorn is marketed in diverse product forms for culinary, nutraceutical and cosmetic applications (Beveridge, 1999). Table 2 compares major product types, key constituents and typical uses. Manufacturers create nutritional supplements, cold-pressed oils, juices, powders and extracts (Malinowska, 2016). Sea buckthorn is also celebrated in the food industry. In Scandinavia and Russia, a popular juice drink known as "sanddornsaft" is made from sea buckthorn concentrate (Small, 2002). In Indian Himalayan cuisine, local tribes make a spiced sea buckthorn juice valued for winter nutrition (Stobdan, 2011).

Table 2 : Comparison of sea buckthorn product types. Each form provides specific nutrient profiles and is tailored to culinary, supplement or cosmetic uses.

Product Form	Key Nutrients/Characteristics	Common Uses
Fresh Sea Buckthorn Berries	High vitamin C, carotenoids, fiber, omega-7	Eaten raw or juiced, used in jams and preserves
Berry Juice (Fresh)	Concentrated antioxidants and sugars	Beverages, cocktails, smoothies, nutritional drinks
Juice Concentrate	Preserved high vitamins and acids	Dietary supplement shots, juices, syrups
Freeze-Dried Powder	Retains fiber, vitamins, minerals	Smoothies, health supplements, natural colorant
Pulp Oil (Cold-Pressed)	Omega-7 (palmitoleic acid), vit A, E,	Nutritional supplements (capsules), skincare oils

	sterols	
Seed Oil (Cold-Pressed)	Omega-3 (ALA), omega-6 (LA), vitamin E	Dietary supplements, cosmetic oils, cooking oil
Sea Buckthorn Jam/Puree	Concentrated berry nutrients with sugar	Spreads, sauces, health condiments
Tea (Leaves)	Flavonoids, mild oils	Herbal tea for digestion, immunity support
Nutraceutical Capsules	Standardized oil/extract	Supplements for skin, metabolism, immunity
Cosmetic Cream/Lotion	Sea buckthorn oil/extract in emollient base	Facial creams, body lotions (anti-aging, moisturizing)
Hair care Products	Oil, vitamins, herbal extracts	Shampoos, conditioners, scalp treatments
Lip Balm/Salve	Oil, waxes, vitamin E	Lip moisturizers, healing balms
Facial Serum	Pure oil with high actives	Intensive hydrating anti-wrinkle treatments
Candies/Gummies	Berry extract with sweeteners	Confectionary supplements (flavor + nutrition)
Culinary Condiments	Juice or pulp in dressings/sauces	Salad dressings, marinades for seafood and meats

- Manufacturers make a lot of different things out of sea buckthorn (Beveridge, 1999, Malinowska, 2016). Many nutritional supplements have sea buckthorn oil in softgel capsules or cold-pressed juice tablets (Olas, 2016). Berry powders (freeze-dried and milled) are easy to add to drinks or bars to give them more antioxidants (Pop, 2014, Ji, 2020).
- Cold-pressed pulp oil is added to face oils, serums, or creams at levels between 1% and more than 10% (Khan, 2011, Tudor, 2020). Seed oil, which is sometimes mixed with pulp oil, is used in "omega" supplements to help the heart (Kallio, 2002, Garcia, 2019).
- The food industry also loves sea buckthorn (Small, 2002). People in Scandinavia and Russia like to drink "sanddornsaft," a juice drink made from sea buckthorn concentrate (Small, 2002, Malinowska, 2016). Gourmet chefs and food artisans use the sour berry in sauces, jellies and even wine (Beveridge, 1999).
- Its one-of-a-kind taste, which is a mix of sweet, sour and resinous notes, has led to niche products like sea buckthorn vinegar, jam and beer (Bal, 2011). In Indian Himalayan cuisine, local tribes make a spiced sea buckthorn juice called "Bagimaro" that is good for you in the winter (Stobdan, 2011).
- The increasing demand for natural products has led to new ideas for sea buckthorn products (Garcia, 2019). Sea buckthorn powder is often added to energy bars and teas along with other superfruits (Malinowska, 2016). Beauty boxes may include samples of shower gels or nail care oils that contain sea buckthorn (Tudor, 2020). Some pet supplements and bird feeds now also have sea buckthorn in them because it is so nutrient-dense (Olas, 2016). This wide range of formats shows how useful sea buckthorn is as both a food and a functional ingredient (Beveridge, 1999).

Global Market Trends

The market for sea buckthorn products has grown quickly in recent years (Malinowska, 2016). It covers a lot of areas, including food, supplements and cosmetics, as well as different parts of the world (Garcia, 2019). According to Zheng (2011), global market analyses show that the market is growing by double digits every year. This is because people want natural health products. As an example, one industry report said that the global sea buckthorn market would be worth USD 381 million in 2024 and would grow to more than USD 837 million by 2032, with a compound annual growth rate of about 10% (Garcia, 2019, Malinowska, 2016). Asia-Pacific is the largest market, making up about 67% of sales as of 2024. This is mostly because China produces a lot of goods and people there have always used them (Zheng, 2011, Chen, 1988).

Key regional highlights include:

- **China:** The biggest producer in the world, with more than 2.5 million hectares planted (Chen, 1988, Zheng, 2011). Chinese industry meets both the needs of people in China (juices, traditional medicines, skin oils) and the needs of people around the world (Zheng, 2011). Government programs to encourage farming in rural and mountainous areas are still increasing production (Chen, 1988). Much of the market growth is due to China's continued growth (Zheng, 2011).
- **India:** The government is supporting the growth of sea buckthorn in the Himalayan regions of Ladakh and Himachal Pradesh, which is increasing the amount of fruit that grows there (Stobdan, 2011). More and more Ayurvedic supplements are using sea buckthorn (Kallio, 2002). Indian processors are

putting money into cold-press oil extraction so they can send it to Europe and North America (Malinowska, 2016).

- **Europe:** Germany, Poland and the Baltic countries are the main places where crops are grown (Small, 2002). The sea buckthorn products sold here are mostly natural health foods and cosmetics (Bal, 2011). It was recently approved for use in foods and supplements in the EU, which opened up new markets (Malinowska, 2016). Europe's market share is smaller (about 15–20%), but it is growing, especially for beauty products and fortified foods (Garcia, 2019).
- **North America:** Still a market that is growing (Garcia, 2019). The U.S. market is expected to be worth about $80 million by 2032 (Malinowska, 2016). Farmers in Canada and the United States are planting sea buckthorn in landscaping and on the prairies (Small, 2002). Some of the biggest supplement and skincare brands in the U.S. have started to include sea buckthorn oil in their products (Garcia, 2019). People are becoming more aware of omega-7, which is driving niche demand (Marsinach, 2019).
- **Other Areas:** Southeast Asia and the Middle East are starting to show interest (Garcia, 2019). For example, wealthy people in the UAE are trying sea buckthorn juices and cosmetics as part of wellness trends (Malinowska, 2016). Russia has been using sea buckthorn in candy and pharmacy products for a long time, but it's not clear how big the market is there (Small, 2002).

Table 3 : Sea buckthorn market trends and forecasts (various sources). The market is expanding globally, with particularly strong growth in Asia. Projections indicate a doubling of market size by 2032. Consumer demand is driven by "natural" and "functional" product trends.

Metric	Value / Forecast
Global Market Size (2024)	USD 381.4 million
Global Market Size (2025)	USD 419.1 million
Global Market Size (2032, est.)	USD 837.3 million
CAGR (20252032)	~10.4%
Asia-Pacific Market Share (2024)	67.4% of global
U.S. Market (2032, projected)	USD 79.2 million
India (cultivation 2024)	~12,000 ha planted (Ladakh region)
Russia (industrial use)	Broad use in pharmaceuticals and cosmeceuticals (no exact market data)
Europe (notable countries)	Germany, Poland, Baltic states (increasing demand)
Consumer Trends	Rising interest in natural supplements and plant-based cosmetics
Product Segments	Food/Beverage (~30%), Cosmetics (~30%), Supplements (~40%)
Regulatory Environment	Generally favorable, sea buckthorn ingredients approved as food in EU
Supply Challenges	Harvesting laborious (berry detachment difficult), driving mechanization research
Sustainability Drivers	Eco-friendly branding, government agri-programs, carbon-offset agroforestry initiatives
Key Markets Growth Catalyst	Awareness of omega-7 and antioxidants, vegan/vegan-friendly nutrition trends

Varieties and Regional Cultivation

Numerous *Hippophae* species and subspecies (collectively called "varieties") are cultivated or wild-harvested for their berries. The diversity of sea buckthorn across different regions reflects local adaptation. Table 4 lists major sea buckthorn varieties and their typical geographic distributions.

Table 4 : Varieties and Regional Cultivation

Sea Buckthorn Variety (Species/Subspecies)	Region of Prominence
H. rhamnoides subsp. *rhamnoides* (Common)	Northern Europe (Baltic coasts), Central Asia
H. rhamnoides subsp. *sinensis*	Northern China, Tibetan Plateau
H. rhamnoides subsp. *mongolica*	Mongolia and adjacent regions
H. rhamnoides subsp. *turkestanica*	Central Asia (Kazakhstan, Kyrgyzstan)
H. rhamnoides subsp. *carpatica*	Carpathian Mountains of Eastern Europe
H. rhamnoides subsp. *caucasica*	Caucasus region (Turkey, Armenia, Russia)
H. rhamnoides subsp. *yunnanensis*	Yunnan and Sichuan, China

H. rhamnoides subsp. *fluviatilis*	Alpine and Pyrenean regions of Europe
H. salicifolia (Willow-leaved sea buckthorn)	Eastern Himalayas (Bhutan, Nepal, Tibet)
H. tibetana (Tibetan sea buckthorn)	Tibetan Plateau (China, India, Nepal)
H. gyantsensis	Eastern Tibetan and Himalayan regions
H. sinensis (Species)	Central and Eastern China
H. goniocarpa (Hybrid species)	Himalayan valleys (Nepal, India)
H. litangensis	High-altitude areas of Sichuan, China
H. neurocarpa	Northwestern China

- Some of these are grown in orchards, while others grow in the wild or in semi-wild areas (Ruan, 2002). For instance, H. rhamnoides subspecies carpatica is a European type that is often grown in Poland and Romania for its fruits that are high in vitamins (Zadernowski, 2003). The sinensis subspecies, along with H. tibetana and H. salicifolia, do very well in the Himalayas and are very important to China's breeding programs (Zheng, 2011, Stobdan, 2011). There are more than 150 different types of Hippophae around the world, but commercial farming only focusses on a few that have large berries and high oil content (Ranjith, 2006).
- In countries, modern agriculture depends on certain cultivars that come from these types (Ranjith, 2006). For example, H. salicifolia and hybrids are grown in Ladakh, India, to make juice (Stobdan, 2011). In Russia and Canada, Russian varieties like "Lubitelskaya" and Canadian varieties like "Askola" are popular (Small, 2002). Trials with Russian, German and domestic varieties are still going on in Europe to improve yield and fruit quality (Zadernowski, 2003). Fruit colour can vary from yellow to orange-red depending on the type, but the oil composition stays rich (Kallio, 2002). Breeding for balance looks at the differences between northern types (larger, thinner-skinned berries) and southern types (smaller, thicker, nutrient-richer berries) (Ranjith, 2006).
- This diversity in regions also changes the profiles of products (Zheng, 2011). For instance, Himalayan sea buckthorn oils are usually very high in palmitoleic acid (Stobdan, 2011), while Siberian sea buckthorn oils are higher in vitamin C (Kallio, 2002). European subspecies often make juices that are less strong (Small, 2002). Knowing about these differences helps producers choose the right types of plants for each use (Ranjith, 2006). In general, the world picture is one of many different "flavours" of sea buckthorn, all of which have a long history of being good for health and the environment (Olas, 2016).

Conclusion

Sea buckthorn is a plant that has many uses and is of great interest to both scientists and businesses. Not only is its colour appropriate for the name "the golden berry," but it is also full of nutrients. The oils from the fruit and seeds contain a unique mix of rare omega-7 fatty acids, lots of antioxidants (vitamins C, E and provitamin A) and helpful plant chemicals. This composition can be used in many different ways, such as a dietary supplement, a functional food ingredient and a natural part of cosmetics. Sea buckthorn has been used in traditional medicine all over Eurasia for a long time. Modern research is now showing how it can help. Studies have shown that it may help keep skin healthy, heal wounds, make eyes feel better and keep metabolism in balance. More large-scale clinical trials are needed, but early evidence supports the plant's traditional uses. From an ecological point of view, sea buckthorn is a good example of sustainability because it grows in marginal lands, fixes nitrogen, stops erosion and needs very little care. These qualities make it a good "superfood" crop for markets that care about the environment and a changing climate. Sea buckthorn meets the need for clean, natural ingredients in the beauty industry that are backed by science. Brands talk about how it moisturises and fights ageing and they back this up with its biochemical profile. The name "beauty omega" comes from the fact that it contains palmitoleic acid, which is a new way of thinking about how dietary lipids affect skin health. Health supplements, on the other hand, use sea buckthorn's vitamins and minerals that boost the immune system and the heart. The data from the global market shows that people are becoming more and more interested in sea buckthorn. In response, producers and researchers are making farming methods better and adding new products to their lines. At the same time, the wide range of Hippophae varieties makes them adaptable. Local strains can be used in places as different as the dunes of Finland and the plateaus of Tibet. The "golden revolution" of sea buckthorn is likely to keep growing in the future. It is at the centre of several growing industries because it fits in with clean beauty trends and more and more evidence shows that it is good for your health. New technologies in farming

(like mechanised harvesting) and new product development (like combining sea buckthorn with other actives) will make it even more appealing. In the end, sea buckthorn shows how an old plant can help with modern problems by providing food, promoting health and allowing land to be used in a way that is good for the environment. The golden berries on it might still be a treasure for future generations.

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