

# A Comprehensive Review of a Magic Plant, *Hippophae rhamnoides*

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## ABSTRACT

Reliance on herbal medicines in the management of diseases is still much experienced by a large share of the people especially rural population due to their easy accessibility and cost effectiveness. Because of greater than before attentiveness regarding significance of conventional medicine in health care, research on medicinal plants would be valuable. *Hippophae rhamnoides* has been used customary in Chinese and Russian medicine for some decades. Today, a range of health products are being manufactured from *Hippophae rhamnoides*. Applications include skin disorders such as eczema, psoriasis, lupus erythematosus and dermatosis, cardiovascular diseases, cancer, burns, digestive tract disorders, anti-inflammation and UV radiations protecting effects. This review aims, (i) to refresh the importance of *Hippophae rhamnoides* to the medicinal plant researchers and (ii) to presents new information such as anti-sebum secretion effects of *Hippophae rhamnoides*.

**Key words:** *Sea Buckthorn*, Topical applications, Magic plant.

## INTRODUCTION

It is postulated that there is a plant for every need on every continent. Remarkably this statement is true for example for soap preparation *saponaria officinalis* (soapwort) is used in Europe, *Yucca glauca* (*yucca*) in USA, *Sapindus indica* (*soapnut*) in India, *Phytolacca dodecandra* (*endod*) in Africa and *Quillaja saponaria* (*soap bark*) in South America.<sup>[1]</sup> *Hippophae rhamnoides* (*Sea Buckthorn*) is a deciduous, dioecious plant with numerous greenish-yellow flowers and bright orange, globular, ellipsoid fruit.<sup>[2]</sup> It is native to Europe, India, Nepal, Bhutan, Pakistan and Afghanistan. *Hippophae rhamnoides* shrub is 2 meter tall with 2-6 cm long leaves. It can be cultivated in deep, well-drained soil with pH 5.5-8.3. *Hippophae rhamnoides* plant can endure a temperature of extreme minimum of 40-43°C.<sup>[3]</sup> The whole plant of *Hippophae rhamnoides* is important however berries are the most important part from which the juice is extracted. The berries (fruit) of *Hippophae rhamnoides* are

matured in three phases. The 1<sup>st</sup> phase is the accelerating seed growth, 2<sup>nd</sup> phase is the declining transition seed growth and the final 3<sup>rd</sup> phase is the known as berry maturation phase. In most part of the world including Pakistan the berries are ripened at the start of September. If the branches are not disturbed then the berries remain whole of the winter attached to the branches.<sup>[4]</sup> *Hippophae rhamnoides* plant has reputed medicinal uses include treatment of skin disorder, peptic ulcers, heart problems and tumors. Because of these characters, the products of *Hippophae rhamnoides* got attraction for medicinal and cosmetics use.<sup>[5]</sup> *Hippophae rhamnoides* plant has resistant to drought, cold, and alkali and salt. The complex root system with nitrogen fixing nodules of the *Hippophae rhamnoides* makes it an optimal pioneer plant in soil and water conservation area.<sup>[6]</sup>

## TAXONOMICAL CLASSIFICATION

It is proposed that taxonomical classification has made greater efforts to conserve existing plant names, for the benefit of phytochemists and other users. A brief taxonomical classification of *Hippophae rhamnoides* is presented in **Table 1**.

### Some physical properties of *Hippophae rhamnoides*

The comparative physical properties of pulp oil and seed oil have been presented in **Table 2**.

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**Table 1: Taxonomical classification of *Hippophae rhamnoides*\***

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Rhamnales
Family	Elaeagnaceae
Genus	<i>Hippophae</i>
Species	<i>rhamnoides</i>

**Table 2: Some physical properties of *Hippophae rhamnoides***

S.No.	Property	Fruit oil	Seed oil
01	Acid value	8.8	10.0
02	Optical rotation	2.10	2.14
03	Refractive index	1.46	1.41

### Plant and Fruit Morphology

*Hippophae rhamnoides* has been used for centuries in Eurasia as food (tea, beverages, jam etc.) as well as for ethnomedical remedies. The fruits are known to be a rich source of vitamins, carotenoids, flavonoids, and phytosterols. Plant fruit morphology of *Hippophae rhamnoides* is described in Table 3.

### Chemical Constituents

Chemical composition of the *Hippophae rhamnoides* varies according to the origin, climate and method of extraction.<sup>4</sup> *Hippophae rhamnoides* consists of Fruit acids, ascorbic acid, Flavonoids, carotinoids, fatty acids and sugar alcohols.<sup>12</sup> Flavonoids are present in all parts of *Hippophae rhamnoides*. Fresh fruits contain 854 mg/100gm while dried leaves contain 3888 mg/100 gm of Flavonoids. The main Flavonoids in *Hippophae rhamnoides* are isorhamnetin, Quercetin, myricetin and kaempferol.<sup>17</sup>

Polyphenoles include flavonols, catechins, proanthocyanidins and chlorogenic acids.<sup>18</sup> The vitamin C concentration in *Hippophae rhamnoides* ranges from 28-2500 mg/100 gm of berries in various subspecies of *Hippophae rhamnoides*. The various factors, which affect the concentration of vitamin C, include temperature, harvesting time, origin and method of processing. Subspecies of *Hippophae rhamnoides* also contain vitamin A, vitamin B1, B2, vitamin K and vitamin P.<sup>14</sup> Seeds and berries have sufficient amount of tocopherols (vitamin E). The concentration of tocopherols and tocotrienols ranges from 100-300 mg/1000 gm in seeds and 110-150 mg/1000 gm of berries. Yellow–orange color of the berries is due the presence of carotinoids. Carotinoids in seeds present in a concentration of 1/20-1/5 to that of berries.<sup>16</sup> Organic acids like malic acid and quinic acids are also present in the *Hippophae rhamnoides* juice. Minerals in

**Table 3: Plant and Fruit Morphology**

Active Growth Period	Spring and Summer
Bloat	None
Coppice Potential	Yes
Fall Conspicuous	Yes
Fire Resistant	No
Flower Color	Yellow
Flower Conspicuous	Yes
Foliage Color	White-Gray
Foliage Texture	Coarse
Fruit/Seed Color	Orange
Fruit/Seed Conspicuous	Yes
Growth Rate	Rapid
Height, Mature	18.0 feet
Nitrogen Fixation	Medium

*Hippophae rhamnoides* juice include potassium, the most abundant, Cu, Cd, Fe, Zn, Mg etc.<sup>14</sup> Fatty acids distribution in the mesocarp and seeds lipids is different. The main fatty acids are palmitoleic acid, palmitic acid, linoleic acid and oleic acid.<sup>19</sup>

### Extraction of *Hippophae rhamnoides*

Due the presence of polar flavonoids, it is usually extracted by water and methanol mixture a ratio of 1:1.<sup>17</sup> Dried branches, seeds and berries of *Hippophae rhamnoides* may also be extracted with 70% ethanol at room temperature.<sup>110</sup> For volatile constituents, the dried fruits of *Hippophae rhamnoides* can be obtained by subjecting it to steam distillation for 4 hours. The volatile constituents are then separated by chloroform and anhydrous sodium sulphate.<sup>19</sup> Chloroform: Methanol mixture in a ratio of 2:1 is used for lipid extraction.<sup>111</sup> Fatty acids and other polar components may also be extracted using n-hexane.<sup>112</sup> Seeds of the *Hippophae rhamnoides* have been successively extracted using chloroform, acetone and methanol in a soxhlet apparatus, however is should be noted that this type of extraction yields less amount of phenolic compounds as compared to methanolic extracts.<sup>113</sup>

### Antioxidant Activity of *Hippophae rhamnoides*

In-vitro study of hydrophilic extract of *Hippophae rhamnoides* showed good antioxidant activity, which was similar to the antioxidant activity of the methanolic extract of *Hippophae rhamnoides*.<sup>14</sup> Ascorbic acid (vitamin C), tocopherols (vitamin E), carotenoids and polyphenols in the seeds, leaves and berries of *Hippophae rhamnoides* have been detected as natural antioxidants.<sup>115</sup> The antioxidant activity of *Hippophae rhamnoides* may be due to its higher phenolic and flavonoid contents.<sup>113</sup> *Hippophae rhamnoides* provides an excellent source of essential fatty acids that is 70% of its composition. The seed oil is used as anti ageing, anti inflammatory, antioxidants and as natural UV blocking agent in cosmetic formulations.<sup>116</sup> The inhibitory effects of alcoholic leaf and fruit extract of *Hippophae rhamnoides* have been investigated to inhibit

the oxidative damage induced by chromium. Alcoholic leaf and fruit extract were found to prevent chromium induced free radical production and restored the antioxidant status. It has been shown that fruit of *Hippophae rhamnoides* inhibit nicotine induced oxidative stress. It has been demonstrated by various in-viv, in-vitro studies that *Hippophae rhamnoides* possesses antioxidant activity.<sup>[17]</sup>

### Uses of *Hippophae rhamnoides*

#### Uses in traditional medicine

*Hippophae rhamnoides* juice is an important source of some valuable chemicals such as vitamin C, tocopherol, microelements, organic acids and polyunsaturated fatty acids. The juice of *Hippophae rhamnoides* was the common medicine used in ancient.<sup>[4]</sup> The leaves and fruits have been used as antiseptic and wound healing as well as in the treatment of ulcers in folk medicines in Turkey.<sup>[9]</sup> T. Beveridge et al reported that *Hippophae rhamnoides* has valuable medicinal importance such as it is used in the treatment of skin disorder resulting from bed incarceration, peptic ulcers (both stomach and duodenal ulcers) and cardiovascular disorders.<sup>[5]</sup> For the past 5 decades *Hippophae rhamnoides* has been used for the treatment of radiation damage, inflammation and burns in Chinese folk medicines.<sup>[13]</sup> *Hippophae rhamnoides* oils have been used in nutraceuticals, natural medicines and cosmetics as raw materials in Russia for some decades.<sup>[6]</sup> *Hippophae rhamnoides* oil extracts have also been used in the treatment of skin disorders such as eczema, psoriasis, lupus erythematosus and dermatosis.<sup>[17]</sup> *Hippophae rhamnoides* has been used in various part of the world as traditional medicine for the treatment of indigestion, cough and blood sepsis.<sup>[10]</sup>

#### Pharmacological effects

Guliyew et al have briefly reviewed pharmacological effects of *Hippophae rhamnoides* plant.

#### Antimicrobial and antitumoral effects

The phenolic compounds of *Hippophae rhamnoides* have the inhibitory effects against Gram-negative bacteria.<sup>[17]</sup> 70% *Hippophae rhamnoides* branches extract has proven activity against TPA induced tumor. This activity is because of three phenolic compounds such as catechin, gallic acid and epigallocatechin.<sup>[10]</sup>

#### Antiulcerogenic effect

Hexane extract of *Hippophae rhamnoides* has activity against indometacin; stress and ethanol induced gastric ulcer.<sup>[17]</sup>

#### Liver diseases

According to Zhao et al *Hippophae rhamnoides* could be used to protect liver from damage by calcium tetrachloride. Combining *Hippophae rhamnoides* juice with antiviral can shorten the normalization time of serum ALT.<sup>[18]</sup>

#### Dermatological effects

*Hippophae rhamnoides* has beneficial effects against dermatological disorders such as atopic dermatitis.<sup>[17]</sup>

#### Anti-sebum secretion effects

Naveed et al has reported the anti-sebum secretion effects of *Hippophae rhamnoides* by formulating a topical skin-care cream. They demonstrated that type 1- $\alpha$  reductase converts testosterone into more potent dihydrotestosterone, which results in the enlargement of sebaceous gland, leading to secreting high level of sebum. The polyphenol plant extract regulates the extreme sebum secretion. Topically applied oleic and linoleic acids have proved to inhibit type 1- $\alpha$  reductase. Polyphenols in *Hippophae rhamnoides* include flavonols, catechins, proanthocyanidins, and chlorogenic acids, whereas the main fatty acids of *Hippophae rhamnoides* are palmitoleic acid, palmitic acid, linoleic acid, and oleic acid which regulate sebum secretion by inhibiting type 1- $\alpha$  reductase.<sup>[19]</sup>

#### Miscellaneous effects

Recent studies have focused on the healthy functions of aromatic and medicinal plants, which have antioxidant, antimicrobial, and mutagen properties.<sup>[20]</sup> Pathogenesis of alcoholic liver disease is mainly due to the generation of an excessive amount of reactive oxygen species (ROS). Antioxidants of plant origin have been reported to either inhibit or prevent the development of fundamental cellular disturbances.<sup>[21]</sup> V.B Guliyew has reported that *Hippophae rhamnoides* has effects on platelet aggregation, effects on blood lipids, electrophysiological effects as well as radioprotective effects have also been shown.<sup>[17]</sup>

## CONCLUSIONS

Research on medicinal plants is increasing day by day. *Hippophae rhamnoides* is a magic plant as it contains a biodiversity of both nutritional as well as medicinal constituents. Targeted based studies with concentration on mechanism of action, lethal dose/effective dose and bioavailability mechanisms need to be conducted in future to explore scientifically the hidden potential of this magic plant so that the ill community gets maximum benefits from our traditional system of medicine. It is hoped, this review will encourage more attention towards research and more conviction towards utilization of herbal medicines.

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